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SITKA SPRUCE -- a bibliography with abstracts

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FOREST SERVICE, U.S. DEPARTMENT OF AGRICULTURE

1970
PORTLAND, OREGON

FOREWORD

This bibliography contains references to world literature on Sitka spruce (*Picea sitchensis* (Bong.) Carr.) published through 1967. A subject matter index appears on pages 234-249, and a list of scientific and common names of tree and plant species mentioned is on pages 250-251. References are listed alphabetically by author.[1]

Abstracts are given for many references. A large number are author abstracts used verbatim or condensed to include a minimum of essential detail. New abstracts were written where appropriate, often excerpting references to Sitka spruce from works dealing with more general subjects. Many abstracts were adapted or taken directly from "Forestry Abstracts," and special thanks are extended to Christopher Swabey, Director, Commonwealth Agricultural Bureaux Organisation, Oxford, for permission to reproduce this material. In compiling the bibliography, the most useful sources of references were "Forestry Abstracts" and "Bibliography of Agriculture," not only in locating references but also in providing title translations of foreign literature. Special effort was made to include the large body of British literature resulting from extensive plantings of Sitka spruce in the British Isles--an important source of information sometimes overlooked by American foresters.

Sincere appreciation is extended to reviewers who pointed out references not found by the compilers, and to the many librarians and others who provided reference material and helped in the preparation of this bibliography.

We would appreciate learning of additional articles on Sitka spruce not included here.

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[1] Publications listed herein are not available from the Pacific Northwest Forest and Range Experiment Station unless issued by the organization. Requests for reprints should be addressed to the author cited.

USDA FOREST SERVICE
RESEARCH PAPER PNW-105

SITKA SPRUCE --

A Bibliography With Abstracts

Compiled by

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1970

PACIFIC NORTHWEST
FOREST AND RANGE EXPERIMENT STATION
Forest Service, U.S. Department of Agriculture
Portland, Oregon

BIBLIOGRAPHY

1. Anonymous.
1903. Lumbering in Alaska. Columbia River and Oregon. Timberman 4(3): 39.

2. ______
1909. Alaska's timber resources. Lumber Rev. 19(23): 18.

3. ______
1915. Logging in Alaska. Timberman 16(4): 48, illus.

Describes logging of Sitka spruce (referred to as Menzies spruce) in Alaska.

4. ______
1928. Seed soaked in sea water remain good. Forest Worker, Nov., p. 8.

5. ______
1932. Pacific coast spruce-hemlock area preserved. J. Forest. 30: 1020.

A tract of 1,400 acres in the Sitka spruce-western hemlock type has been set aside as the Quinault Natural Area. The tract contains some of the finest specimens of Sitka spruce to be found in the few remaining stands of old-growth timber.

6. ______
1942. Alaskan spruce for national defense. Amer. Forest. 48: 354-355, illus.

7. ______
1944. Popular misconceptions refuted in kiln-drying tests on Sitka spruce at Vancouver laboratories. Brit. Columbia Lumberman 28(12): 72-73.

Describes the effect of various kiln schedules on strength properties of Sitka spruce. With proper schedules, kiln-drying does not impair strength.

8. ______
1955. Canadian seeds used in Welsh forests. Brit. Columbia Lumberman 39(9): 34, illus.

Twice as many Sitka spruce trees are planted in Wales as any other species. The spruce grows well on the highlands, being hardy and resistant to exposure.

9. ______
1957. Alaska's logging operations pose unusual conditions. Timberman 58(12): 98.

10. ______
1957. Massenauftreten der Sitkalaus. [Mass outbreak of *Neomyzaphis abietina*.] Holz-Zentralbl. 83(70/71): 903-904. [In German.]

11. ______
1959. Canadian building timbers. Wood 24(8): 322-325, illus.

12. ______
1962. Sitka spruce named Alaska State tree. J. Forest. 60: 370.

On February 28, 1962, the Governor of Alaska signed a bill designating Sitka spruce as Alaska's official State tree.

13. _______
1962. B. C. Sitka spruce excels in Coventry Church. Brit. Columbia Lumberman 46(7): 76-77, illus.

Sitka spruce was used for the decorative inner canopy of the roof of the nave. In Great Britain, B.C. Sitka spruce has been widely used in aircraft and boatbuilding, and for highly stressed components in ladders, agricultural machinery, and vehicle bodies. For its resonance it finds favor with the makers of pianos and stringed instruments of all kinds.

14. _______
1964. Liability of trees on peat to wind-throw. Scot. Forest. 18(1): 38-43.

15. _______
1965. Alaska timber sales: Tongass National Forest sale volume 8.7 billion board feet. Forest Ind. 92(10): 64-65, illus.

A sale of 8,750 million board feet of timber was offered by the USDA Forest Service. The stand is estimated to contain about 44 percent western hemlock and 56 percent Sitka spruce, with small amounts of other species.

16. _______
1967. Target: 75 million seedlings by 1975. Brit. Columbia Lumberman 51(10): 40, illus.

The Forest Service officially opened a major forest nursery at Koksilah which will concentrate on growing Sitka spruce and western hemlock and will be capable of producing 7 million seedlings each year.

17. Aaron, J. R.
1957. Conifer barks as a source of tannins for the leather industry. Scot. Forest. 11(2): 72-76.

Analysis of 31 samples of Sitka spruce bark from trees grown in Great Britain showed an average tannin content of 17.5 percent. Percentage yield from dominant trees was higher than from suppressed trees. Yield was higher when bark was handpeeled than when bark was removed mechanically or chemically.

18. _______
1963. An interim report on field trials of treated and untreated round fencing timber. *In* Report on forest research for the year ended March 1962. Great Brit. Forest. Comm., pp. 133-137. London: H. M. Stationery Office.

19. Abdurahman, N., Dutton, G. G. S., McLardy, D. M., and others.
1964. Hemicelluloses of black spruce, Sitka spruce, ponderosa pine, and Douglas-fir. Tappi 47: 812.

Chlorite holocelluloses of each of the four woods were extracted with alkali and the hemicelluloses separated into fractions rich in "xylan," "galactoglucomannan," and "glucomannan." The characteristics of the extracts made from the different woods are compared.

20. Abell, J.
1954. Lokale Douglasovervejelser. [Douglas-fir in Denmark.] Dansk Skovforen. Tidsskr. 39(1): 1-60. [In Danish.]

21. Abrams, Leroy.
1940. An illustrated flora of the Pacific States, Washington, Oregon, and California. Vol. 1, ed. 2, 538 pp., illus. Stanford: Stanford Univ. Press.

22. Ackers, C. P.
1947. Practical British forestry. Ed. 2, 394 pp., illus. London: Oxford Univ. Press.

Describes briefly the silviculture of Sitka spruce in Britain.

23. Adams, Bristow.
1903. The Unalaska spruce plantation. Forest. & Irrig. 9: 382-385, illus.

Describes Sitka spruce planted in the Aleutian Islands in 1805 by the Russians and discusses the natural treelessness of the Aleutians.

24. Addison, John W.
1966. Nutrient experiments with Sitka spruce. 76 pp., illus. (B.S. in Forestry thesis on file at Univ. Brit. Columbia, Vancouver.)

25. Ahrens, Von E.
1964. Untersuchungen über den Gehalt von Blättern und Nadeln verschiedener Baumarten an Kupfer, Zink, Bor, Molybdän und Mangan. [The content of Cu, Zn, B, Mo, and Mn in foliage of various tree species.] Allg. Forst- und Jagdzeit. 135(1): 8-16. [In German. English summary.]

Analyses of chemical elements in the foliage of several tree species, including Sitka spruce, as related to site, season, and other factors.

26. Ainslie, J. R.
1941. Timbers used in the construction of aeroplanes. Wood 6: 60-63, illus.

The species most commonly used in aircraft construction are ash and Sitka spruce. The material characteristics required for each part of the plane are discussed; the timbers now in use are given, and others that should be suitable are suggested.

27. Alaska University.
1967. The Kodiak economic community. Alaska, review of business and economic conditions. Univ. Alaska Inst. Soc., Econ., Government Res. 8 pp., illus.

Afognak Island, the smaller islands around it, and the northeast tip of Kodiak Island have valuable stands of Sitka spruce. Tree quality is lower than in southeast Alaska, and the stands are very heavily stocked. There are 270,000 acres of commercial forest land on the Archipelago. Plans and possibilities for commercial development are described.

28. Aldhous, J. R.
1959. Control of cutworm in forest nurseries. Forestry 32(2): 155-165.

Experiments were made to investigate the effect of BHC, DDT, aldrin, and dieldrin on cutworms (*Agrotis segetum*) and the phytotoxicity of these chemicals to Sitka spruce seedlings. A spray containing 3 pounds aldrin per acre (as a 30-percent miscible oil) or 1½ pounds dieldrin per acre (as a 15-percent miscible oil) gave excellent control of *A. segetum* larvae and did no damage to the seedling crop. Both insecticides were applied in 100 gallons water per acre.

29. ________ 1959. Polythene bags for movements of forest nursery stock. Empire Forest. Rev. 38(1): 65-76.

Polyethylene bags were tested in England to reduce drying of nursery stock during storage and transport. Sitka spruce seedlings lifted beginning in mid-November and stored up to 6 months survived outstandingly well after planting.

30. ________ 1960. A preliminary experiment on conifer seedbeds with 2, 6-dichlorobenzonitrile. Fifth Brit. Weed Contr. Conf. Proc. 1960: 617-624.

The material, worked into the top 2-3 inches of conifer seedbeds at 1 or 2 pounds per acre (active principle), completely controlled annual weeds from the time of application until mid-July, when it was applied as a wettable powder 8, 4, or 2 weeks before the plots were sown in early April or early May. The number and height of Sitka spruce seedlings was seriously reduced by applications of 2 pounds per acre and by some, but not all, applications of 1 pound; on plots treated with 1 pound per acre 4 or 8 weeks before sowing, weed control was good and Sitka spruce seedlings were undamaged. Applications of one-half pound per acre had little effect on crop or weeds. Surface applications also had little effect on crop or weeds. (From author's summary.)

31. ________ 1961. Experiments in hand-weeding of conifer seedbeds in forest nurseries. Weed Res. 1(1): 59-67.

32. ________ 1962. A survey of Dunemann seedbeds in Great Britain. Quart. J. Forest. 56(3): 185-196.

Describes results obtained from raising seedlings in Dunemann seedbeds as compared with results obtained with mineral seedbeds. Includes recommendations for the construction and operation of the beds.

33. ________ 1962. Simazine--a weedkiller for forest nurseries. *In* Report on forest research for the year ended March 1961. Great Brit. Forest. Comm., pp. 154-165. London: H. M. Stationery Office.

34. ________ 1962. Provenance of Sitka spruce: an account of the nursery stage of experiments sown in 1938. *In* Report on forest research for the

year ended March 1961. Great Brit. Forest. Comm., pp. 147-154. London: H. M. Stationery Office.

Reports the first 3 years' growth of 12 provenances collected between latitudes 61° and 43° N. from the northwest coast of America. Height growth increased as latitude decreased, especially in the range 61° to 49°, the taller provenances having the longer growing period; root-collar diameter and seedling weight did not vary with latitude of origin so clearly. The time of cessation of growth in late summer varied by up to 3 months, the last provenances to stop growing being damaged by frost. (From author's summary.)

35. ________ 1964. The effect of paraquat, 2, 6-dichlorothiobenzamide and 4-amino 3, 5, 6-trichloropicolinic acid ('Tordon') on species planted in the forest. Seventh Brit. Weed Contr. Conf. Proc. 1964(1): 267-275.

36. ________ 1964. Cold storage of forest nursery plants. An account of experiments and trials; 1958-63. Forestry 37(1): 47-63.

Sitka spruce seedlings were found suitable for storage from February until late May. Seedlings may be stored until August if surplus seedlings are being held over. Plants must be fully dormant when lifted, must not be put into storage until any rain or dew has dried off them, and should be stored in polythene bags.

37. ________ 1965. Bitumen mulches. *In* Report on forest research for the year ended March 1964. Great Brit. Forest. Comm., pp. 15-16. London: H. M. Stationery Office.

Bitumen mulch sprayed on seedbeds 3 to 4 weeks after sowing depressed germination of Sitka spruce drastically. For transplants, light and heavy application of bitumen between or over rows had no significant effect on survival or growth.

38. ________ 1965. Chemical control of weeds in the forest. Great Brit. Forest. Comm. Leafl. 51, 20 pp., illus.

Selective control of herbaceous and young broadleaved woody weeds can be accomplished with 2,4,5-T or a mixture of 2,4-D and 2,4,5-T, if spraying is done after conifer shoots have ceased elongation and formed buds. Sitka spruce is relatively resistant to sprays applied after mid-August.

39. ________ 1965. Fertilizer damage to transplants. *In* Report on forest research for the year ended March 1964. Great Brit. Forest. Comm., p. 16. London: H. M. Stationery Office.

Experiments at three nurseries with seedlings transplanted in the late spring showed Sitka spruce seedlings were unaffected by double the standard application of potassic superphosphate. *Abies procera* and *Picea abies* seedlings showed marked browning of foliage.

40. _______
1966. Paraquat as a pre-emergence spray for conifer seedbeds. *In* Report on forest research for the year ended March 1965. Great Brit. Forest. Comm., pp. 133-140. London: H. M. Stationery Office.

In experiments in 1962-64, preemergence sprays of paraquat did not affect most of the commonly sown conifers including Sitka spruce. The control of weeds achieved with paraquat at 0.5 pound active ingredient per acre was sometimes better and sometimes poorer than that following sprays of vaporizing oils. Postemergence sprays killed all conifer species under test, but pines and spruces took several weeks to react to postemergence sprays. (From author's summary.)

41. _______
1966. The effect of paraquat, 2, 6-dichlorothiobenzamide and 4-amino 3, 5, 6-trichloropicolinic acid ('Tordon') on species planted in the forest. *In* Report on forest research for the year ended March 1965. Great Brit. Forest. Comm., pp. 141-149. London: H. M. Stationery Office.

42. _______
1966. Bracken control in forestry with dicamba, picloram, and chlorthiamid. Eighth Brit. Weed Contr. Conf. Proc. 1966: 150-159.

43. _______
1967. Spacing in transplant lines. *In* Report on forest research for the year ended March 1966. Great Brit. Forest. Comm., p. 25. London: H. M. Stationery Office.

44. _______
1967. Review of research and development in forest nursery techniques in Great Britain, 1949-1966. Great Brit. Forest. Comm. Res. & Develop. Pap. 46, 11 pp.

45. _______
1967. Standards of sturdiness for forest tree plants. Great Brit. Forest. Comm. Res. & Develop. Pap. 36, 11 pp., illus.

Lists ratios of diameter to height for a range of species, including Sitka spruce.

46. _______
1967. Progress report on chlorthiamid ('Prefix') in forestry: 1962-1966. Great Brit. Forest. Comm. Res. & Develop. Pap. 49, 6 pp.

Sitka spruce was less affected by the herbicide chlorthiamid at 4 pounds per acre than most species tested.

47. _______ and Atterson, J.
1962. Nursery investigations. *In* Report on forest research for the year ended March 1961. Great Brit. Forest. Comm., pp. 19-27. London: H. M. Stationery Office.

48. _______ and Atterson, J.
1963. Nursery investigations: storage of plants at low temperatures. *In* Report on forest research for the year ended March 1962.

Great Brit. Forest. Comm., pp. 20-22. London: H. M. Stationery Office.

49. _______ and Atterson, J.
1967. Weed control in the forest. *In* Report on forest research for the year ended March 1967. Great Brit. Forest. Comm., pp. 70-73. London: H. M. Stationery Office.

50. _______, Atterson, J., Brown, R. M., and others.
1967. Nursery investigations. *In* Report on forest research for the year ended March 1967. Great Brit. Forest. Comm., pp. 28-39. London: H. M. Stationery Office.

Describes work with Sitka spruce, including investigation of effects of density of sowing, date of sowing (on two provenances), bird repellents, fertilizer treatments, and simazine for weed control.

51. Allen, G. S.
1957. Storage behavior of conifer seeds in sealed containers held at 0° F., 32° F., and room temperature. J. Forest. 55: 278-281.

Indications are that Sitka spruce seed can be stored without appreciable loss of viability at 0° F. or 32° F. and presumably over a wider range of temperatures. Seed at fluctuating room temperature lost its viability over the 5- to 7-year test period.

52. Allen, George S.
1944. Management recommendations for the hemlock and associated forest types of the Juan de Fuca region of southwestern Vancouver Island. Brit. Columbia Forest Serv. Res. Note 11, 13 pp., illus.

53. Allen, M. G.
1962. The use of selective herbicides for conifer release. Sixth Brit. Weed Contr. Conf. Proc. 1962: 435-444.

A study was made in Scotland of damage sustained by different conifer species of varying ages after treatment with a mixture of low-volatile esters of 2,4-D plus 2,4,5-T (2/1 mixture) at three different dosages and in three diluents: water, water/oil, and oil. Plots were sprayed at monthly intervals beginning in September and ending in February. With water, no damage was sustained by any species at any dose. With water/oil, *Pinus sylvestris* and Sitka spruce sustained no serious damage at any dose. With oil, Sitka spruce was damaged at all dosages. Further trials of different formulations and volumes showed that in summer spraying Sitka spruce sustained no injury from 2,4,5-T at 20, 40, or 60 ounces per acre in 15 gallons or 150 gallons water.

54. _______
1967. Experiments with 2, 6-dichlorothiobenzamide (chlorthiamid) in planted areas of soft- and hardwoods. Eighth Brit. Weed Contr. Conf. Proc. 1967: 135-140.

55. Amchem Products, Inc.
1962. Oil-soluble amines of 2,4-D and 2,4,5-T for the control of woody plants and broadleaf weeds. Tech. Serv. Data Sheet, Ambler E-162, 15 pp. [Abstract in Weed Abstr. 11(6): 1847.]

56. American Forestry Association.
1956. These are the champs. Part 2. Amer. Forests 62(4): 33-40, illus.

The largest Sitka spruce reported is in Olympic National Park, Washington. It has a circumference of 51 feet, 6 inches, a height of 180 feet, and a crown spread of 50 feet.

57. American Plywood Association.
1966. U.S. Product Standard PS 1-66 for softwood plywood-construction and industrial together with DFPA grade marks. Tacoma, Wash. 28 pp., illus.

58. Andersen, H. E.
1955. Climate in southeast Alaska in relation to tree growth. USDA Forest Serv. Alaska Forest Res. Center Sta. Pap. 3, 11 pp., illus.

Rainfall in southeast Alaska is probably excessive for optimum tree growth as high rainfall tends to cause an excess of ground water. Best sites are well drained. Low temperatures during the growing season may limit tree growth as shown by the preponderance of high site classes on south slopes and decrease of average site index in the northern section. A compilation of climatic data for southeast Alaska is included.

59. ________
1955. Clearcutting as a silvicultural system in converting old forests to new in southeast Alaska. Soc. Amer. Forest. Proc. 1955: 59-61.

The present stand in southeast Alaska is a decadent climax with heavy cull. The goal of forest management is an even-aged stand composed of approximately equal volumes of western hemlock and Sitka spruce.

60. ________
1955. Girard form class comparisons for three major species in southeast Alaska. USDA Forest Serv. Alaska Forest Res. Center Tech. Note 26, 2 pp.

The average form class of Sitka spruce and western hemlock was respectively 76.4 and 75.8 for 32-foot logs and 82.4 and 82.2 for 16-foot logs. The difference between the species is not significant for either subclimax sawtimber or climax pulp timber, and their mean may be considered as 76 for 32-foot and 82 for 16-foot logs.

61. ________
1956. Cubic-foot volume tables for spruce and hemlock poletimber. USDA Forest Serv. Alaska Forest Res. Center Tech. Note 29, 1 p.

Presents gross cubic-foot volume of peeled wood from a 1-foot stump to a 4-inch top for poles in 6-, 8-, and 10-inch d.b.h. classes and total heights between 20 and 110 feet.

62. ________
1956. The problem of brush control on cutover areas in southeast Alaska. USDA Forest Serv. Alaska Forest Res. Center Tech. Note 33, 2 pp.

A dosage of 54 pounds of crystals per acre of NH_4 sulfamate caused defoliation of nearly all brush. Many hemlock seedlings died but Sitka spruce proved more resistant. As costs were high and there was much resprouting, other methods of control should be tried.

63. _______ and Weisgerber, J. E.
1956. Use of long-log scaling tables in southeast Alaska. USDA Forest Serv. Alaska Forest Res. Center Tech. Note 32, 2 pp.

Long-log board-foot tables based on Scribner Decimal C rule were made for water scaling logs longer than 42 feet. These were based on a study which indicated that the average taper of western hemlock and Sitka spruce logs in southeast Alaska was 1 inch per 6 feet of log length.

64. Andersen, K. F.
1954. Gales and gale damage to forest with special reference to the effects of the storm of 31st January, 1953, in the northeast of Scotland. Forestry 27: 97-121 plus 1 plate.

Describes storm damage to Sitka spruce and associated species.

65. Anderson, J. P.
1918. Plants of southeastern Alaska. Iowa Acad. Sci. Proc. 1918(25): 427-449.

66. Anderson, Jacob Peter.
1959. Flora of Alaska and adjacent parts of Canada. 543 pp., illus. Ames: Iowa State Univ. Press.

67. Anderson, James R.
1925. Trees and shrubs. Food, medicinal, and poisonous plants of British Columbia. 165 pp., illus. Victoria, B.C.: Dep. Educ.

68. Anderson, M. L.
1930. A case of "damping-off" induced by the use of wood-ashes as a manure on seed-beds. Scot. Forest. J. 44(1): 7-16 plus 2 graphs.

69. Anderson, Mogens.
1951. Balancen I blandingsbevoksninger af rød-og Sitka-gran. [The balance in mixed plantations of Norway and Sitka spruce.] Skovforen. Tidsskr. 36(1): 1-44, illus. [In Danish.]

Describes the effect of light, winter temperatures, drought, soil, position, elevation, damage by wind, and disease on the balance between Sitka spruce and Norway spruce in a Danish plantation.

70. Anderson, R. T.
1937. Pruning green branches of conifers. Quart. J. Forest. 31(1): 29-31, illus.

71. Andrews, H. J., Cowlin, R. W., Moravets, F. L., and Meyer, W. H.
1935. Pulpwood resources of western Oregon and western Washington. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Res. Note 17, 6 pp. plus 12 tables and 5 figs.

72. Andrews, I. H.
1949. Zinc hydrosulphite treatment of groundwood. Tappi 32: 286-288.

Gives values of improved brightness for various treatment rates and temperatures of ground wood from western hemlock, Sitka spruce, and balsam fir.

73. Andrews, L. R.
1956. B. C.'s timber industry today. Brit. Columbia Lumberman 40(11): 40-48; 40(12): 40-44, illus.

74. Annand, J. F.
1912. The annual summer meeting and tour of the Royal English Arboricultural Society, Perth, July 29th to August 2nd, 1912. Quart. J. Forest. 6: 303-328, illus.

Several specimens of Sitka spruce were viewed during the tour.

75. Appleton, J. B.
1939. The Pacific Northwest: a selected bibliography, 1930/39. 455 pp. Portland, Oreg.: Northwest Regional Council.

Lists completed research in the natural-resource and socioeconomic fields with an annotated list of in-progress and contemplated research.

76. Aranda, Martin J., and Coutts, J. R. H.
1963. Micrometeorological observations in an afforested area in Aberdeenshire: rainfall characteristics. J. Soil Sci. 14(1): 124-133.

Rainfall was measured at an open site and under Sitka spruce, pine, and heather. Between 50 and 60 percent of the rain penetrated each of the canopies. Variations in the percentage penetration are associated with the area of foliage to be wetted and with the aggregate amount and intensity of the rainfall. (From author's summary.)

77. Archer, C. F.
1952. Kiln-drying schedules for British Columbia woods. Can. Dep. Resources & Develop., Forest. Br., Forest Prod. Lab. Div. V-1012, 18 pp.

The wood of all western spruces is practically indistinguishable and can be seasoned under the same conditions. Schedules are given.

78. Armit, D.
1964. Natural nurseries. Brit. Columbia Forest Serv. Forest Res. Rev. (year ending March 1964), p. 26.

Reports on a continuing project to produce Sitka spruce wildlings by manipulating the canopy and forest floor and then comparing these wildlings with seedlings grown in standard nursery beds. Conclusions: 3+0 is superior to 2+0 as a planting size; fertilization does not improve growth of the wildlings; 2+0 standard nursery stock is superior to 2+0 natural nursery stock.

79. ________
1964. Sitka spruce spacing trial. Brit. Columbia Forest Serv. Forest Res. Rev. (year ending March 1964), pp. 29-30.

80. ________
1967. Sitka spruce spacing trial. Brit. Columbia Forest Serv. Forest Res. Rev. (year ending March 1967), p. 67.

Reports on Sitka spruce spacing trials established in 1961 west of Kalum Lake. Spacings range from 6 by 6 to 15 by 15 feet. Measurements of average height in 1966 indicated no significant differences related to spacing or block effects. Crown closure is expected on the 6-by 6-foot plots and possibly on the 9-by 9-foot plots by the next measurement in 1971.

81. Armstrong, F. H.
1935. Further tests on the effect of progressive decay by *Trametes serialis* Fr. on the mechanical strength of the wood of Sitka spruce. Forestry 9: 62-64.

A close relationship was found between reduction in resistance to compression and the progress of decay as measured by the loss in dry weight. Advance of fungal attacks was indicated by an increase in brittleness and irregularity of fracture.

82. ________
1947. The strength of home-grown timber pit-props. Forestry 21(1): 43-76.

Results of strength tests on European and Japanese larch, Norway spruce, Scotch pine, Corsican pine, Douglas-fir, and Sitka spruce showed the spruce to be below average in strength.

83. Arno, Stephen F.
1967. Interpreting the timberline: an aid to help park naturalists to acquaint visitors with the subalpine-alpine ecotone of western North America. 206 pp., illus. San Francisco: U.S. Dep. Int. Nat. Park Serv. Western Reg. Office.

Describes Sitka spruce at timberline throughout its range.

84. Arthur, Joseph Charles.
1934. Manual of the rusts in United States and Canada. 438 pp. plus supplement, illus. Lafayette, Indiana.

The following rusts are found on Sitka spruce: *Melampsorella cerastii, Chrysomyxa ledicola,* and *Peridermium parksianum.*

85. Aspinall, G. O., Laidlaw, R. A., and Rashbrook, R. B.
1957. The glucomannans from Sitka spruce *Picea sitchensis.* J. Chem. Soc. (London), pp. 4444-4448.

Hemicellulose fractions composed of *d*-mannose and *d*-glucose residues have been isolated from Sitka spruce holocellulose. A methylated glucan and a methylated glucomannan have been prepared therefrom, hydrolysis affording the corresponding 2 : 3 : 6-trimenthyl ethers. It is concluded that both glucan and glucomannan are linear polysaccharides composed of B-1 : 4-linked sugar residues. (From author's summary.)

86. Atterson, J.
1965. Magnesium deficiency in pines. *In* Report on forest research for the year ended March 1964. Great Brit. Forest. Comm., pp. 16-17. London: H. M. Stationery Office.

A symptom of magnesium deficiency (yellowing) of Sitka spruce in nursery beds was removed by spraying seedbeds with Epsom salt solution. A more promising source of magnesium is magnesium ammonium phosphate.

87. ———
1965. Weed control in the nursery. *In* Report on forest research for the year ended March 1964. Great Brit. Forest. Comm., pp. 17-19. London: H. M. Stationery Office.

88. ———
1966. Amelioration of forest sites. (1) Nutrition. (a) Forest nutrition in Scotland and northern England. *In* Report on forest research for the year ended March 1965. Great Brit. Forest. Comm., pp. 21-25. London: H. M. Stationery Office.

89. Austin, R. C., and Strand, R. F.
1960. The use of slowly soluble fertilizers in forest planting in the Pacific Northwest. J. Forest. 58: 619-627, illus.

Describes response of planted Sitka spruce seedlings to fertilization.

90. Ayers, H. B.
1899. Washington Forest Reserve. *In* Nineteenth annual report 1897/98. Part 5. Forest Reserves. U.S. Geol. Surv., pp. 283-313, illus.

91. Babb, M. F.
1959. Ornamental trees and shrubs for Alaska. Univ. Alaska Agr. Exp. Sta. Bull. 24, 39 pp., illus.

92. Baerg, Harry J.
1955. How to know the western trees: pictured keys to the native and cultivated trees found growing in the Rocky Mountains and westward, with suggestions and aids for their study. 170 pp., illus. Dubuque, Iowa: W. C. Brow Co.

93. Bailey, Harold E., and Bailey, Virginia Long.
1941. Forests and trees of the western National Parks. U.S. Dep. Interior Nat. Park Serv. Conserv. Bull. 6, 129 pp., illus.

94. Bailey, L. H.
1948. The cultivated conifers in North America. Ed. 2, 404 pp., illus. New York: Macmillan Co.

95. Bailey, Virginia L., and Bailey, Harold E.
1949. Woody plants of the western National Parks; containing keys for the identification of trees and shrubs. Amer. Midland Natur. Monogr. 4, 274 pp., illus.

96. Baker, F. S.
1949. A revised tolerance table. J. Forest. 47: 179-181.

Sitka spruce is rated very tolerant to tolerant on a relative scale of very tolerant, tolerant, intermediate, intolerant, and very intolerant.

97. Baker, Frederick S.
1929. Effect of excessively high temperatures on coniferous reproduction. J. Forest. 27: 949-975, illus.

98. ________
1950. Principles of silviculture. 414 pp., illus. New York: McGraw-Hill Book Co.

99. Baker, William J.
1929. Moisture reabsorption study of kiln-dried Sitka spruce. Timberman 30(8): 86.

100. Bakke, A. R. F.
1960. Douglaslusa funnet pa sorlandet. [The Cooley spruce gall aphid found on the South Coast.] Norsk Skogbruk 6(1): 12, illus. [In Norwegian. English summary.]

The aphid *Adelges cooleyi* = (*Chermes cooleyi*) has been recorded on Douglas-fir and Sitka spruce near Grimstad on the south coast of Norway. This is the first record on Sitka spruce in Norway.

101. Baldwin, E.
1967. A fertiliser trial on deep peat. Scot. Forest. 21(4): 229-231.

Sitka spruce and lodgepole pine were planted on deep peat in 1956 and each seedling received 2 ounces of ground mineral phosphate. A subsequent fertilizer treatment in 1961 containing 14 percent nitrogen, 2.5 percent phosphorus, and 16.5 percent potassium improved growth for a period of time apparently related to the rate of application. Annual shoot growth started to fall off appreciably 4 years after fertilizer application of 500 pounds per acre.

102. Balfour, F. R. S.
1932. The history of conifers in Scotland and their discovery by Scotsmen. Conifers in cultivation. Conifers Conf. Roy. Hort. Soc. Rep., Nov. 10-12, 1931, pp. 177-211, illus.

Sitka spruce was introduced into Britain by David Douglas. Many specimens over 100 feet tall are reported, and occasional trees have reached 130 feet. During the war, spruce timber was imported under the name "silver spruce."

103. Balfour, R. M., and Kirkland, R. C.
1963. The effect of creosote on populations of *Trypodendron lineatum* breeding in stumps. *In* Report on forest research for the year ended March 1962. Great Brit. Forest. Comm., pp. 163-166. London: H. M. Stationery Office.

Incidence of attack by *T. lineatum* was low on Sitka stumps whether creosote-treated or not, and successful emergence of adults was rare compared with that from logs.

104. Bandekow, Richard J.
1947. Present and potential sources of tannin in the United States. J. Forest. 45: 729-734.

Sitka spruce bark contains about 25 percent tannin but it has not been used by the tanning industry.

105. Bannan, M. W.
1963. Cambial behaviour with reference to cell length and ring width in Picea. Can. J. Bot. 41: 811-822, illus.

Interrelations between frequency of multiplicative divisions, cell length, and ring width in *Picea* largely resembled those in *Pinus strobus*. Maximum cell length was observed in *P. sitchensis*, and minimum in *P. engelmannii*, which also had fewest multiplicative divisions (the other species studied were *P. glauca* and *P. mariana*). Orientation of the partition in pseudotransverse division tended to be unidirectional, but reversal of direction of tilt occurred after varying intervals. The connection of these phenomena with the development of spiral grain is discussed.

106. Barrett, John W. (ed.)
1962. Regional silviculture of the United States. 610 pp., illus. New York: Ronald Press.

Presents an area-by-area guide to the biological, physical, and economic aspects of the Nation's continental forest regions and their effect on efficient and productive silviculture practices. Describes silviculture of the major forest type groups of the Pacific Northwest, both in the coastal subzone and the humid transition zone. Description for each group includes the typical site where the group occurs, its place in ecological succession, growth rates, rotations, cultural practices, reforestation, and susceptibility to damage.

107. Bartels, H.
1958. Untersuchungen uber die Hitzetoleranz der Koniferensamen. [Investigations on the heat tolerance of conifer seeds.] Forstwiss. Cent. 77(9/10): 287-294. [In German.]

Gives heat tolerance of seeds of several conifers, including Sitka spruce.

108. Bartholomew, C. R.
1955. Effect of an agricultural spray on forest trees. Quart. J. Forest. 49(2): 139-140.

109. Barton, Lela V.
1930. Hastening the germination of some coniferous seeds. Amer. J. Bot. 17(1): 88-115.

Germination percent was improved by stratifying Sitka spruce seed for 2 months at 5° C.

110. ________
1954. Effect of subfreezing temperatures on viability of conifer seeds in storage. Boyce Thompson Inst. Contrib. 18(1): 21-24, illus.

Seeds of five conifer species, including Sitka spruce, were stored in canvas bags at subfreezing temperatures of approximately -4°, -11°, and -18° C. for 3 years. Storage temperature of -18° C. was found best for maintaining viability. Deterioration was most rapid at -4° C.

111. Bauer, Franz.
1956. Heideaufforstung in Dänemark. [Heathland afforestation in Denmark.] Holz-Zentralbl. 32(136): 1647-1648, illus. [In German.]

Describes two trial plots near Ulvborg, Jutland, on poor, mostly shallow, sandy soils where groups of various species, now 17-23 years old, were established by hole planting under shelter of a first forest generation of *Pinus mugo* and *P. mugo* var. *rostrata*. Height growth and general appearance are discussed and partly tabulated. *Larix japonica, Picea abies,* and *P. sitchensis* are considered most promising, and *Abies alba* is recommended on biological grounds.

112. Bauger, E.
1961. Forelopig produksjonstabell for Sitkagran på Vestlandet. [Preliminary yield table for Sitka spruce in W. Norway.] Medd. Vestlandets Forstl. Forsøkssta. 35: 123-167. [In Norwegian. English summary.]

Table is based on data from permanent sample plots in pure stands, none of which exceed 44 years of age.

113. _______ and Smitt, A.
1960. Et treslags-og proveniensforsøk på Stad. [An experiment on tree species and provenances on Stad.] Medd. Vestlandets Forstl. Forsøkssta. 34: 59-121 plus 40 photos, diagram. [In Norwegian. English summary.]

Sitka spruce gave the most promising results of several species tried on a windswept peninsula in west Norway. It was able to withstand wind when growing on good, deep soils with sufficient moisture. An Alaska provenance gave better results than one from British Columbia.

114. Bauger, Eivind, and Orlund, Arnstein.
1962. Undersøkelser etter kvisting I treslagene Sitkagran, *Abies grandis*, hemlock, gran og Thuja. [A study of pruned trees of Sitka spruce, *Abies grandis*, western hemlock, Norway spruce, and *Thuja plicata*.] Medd. Vestlandets Forstl. Forsøkssta. 36: 172-197, illus. [In Norwegian. English summary.]

A study of 2,016 knots led to the following conclusions: (1) pruning (either green or dry, usually at about 2 m.) did not cause rot or other defects of practical importance; (2) pruning season (autumn, winter, and late spring) had no effect; (3) stub length tended to increase with branch diameter, especially for hemlock; (4) the time taken for stub healing tended to increase with stub length and to decrease with increasing knot diameter. Results under (3) and (4) are so variable, however, that no reliable conclusions can be drawn.

115. Bavngaard, A.
1957. Negatieve grene. [Negative branches.] Dansk Skovforen. Tidsskr. 42(12): 601-634. [In Danish.]

Restates the author's theory that suppressed branches live at the expense of the tree as a whole, citing as supporting evidence examples from 17-year-old Sitka spruce.

116. Baxter, Dow V.
1942. Some resupinate polypores from the region of the Great Lakes, XIII. Mich. Acad. Sci., Arts, Lett. 27: 139-161, illus.

117. _______
1947. Occurrence of forest fungi in major forest types of Alaska. Pap. of Mich. Acad. Sci., Arts, Lett. for 1945, 31: 93-115, illus.

118. _______
1952. Pathology in forest practice. Ed. 2, 601 pp. New York: J. Wiley & Son. (Ed. 1, 1943, 618 pp.)

119. Baxter, D. V., and Varner, R. W.
1942. Importance of fungi and defects in handling Alaskan airplane spruce. Univ. Mich. Sch. Forest. Conserv. Circ. 6, 35 pp.

120. Beach, John E. G.
1939. The pruning of Scots pine and Sitka spruce. Scot. Forest. J. 53: 85-89.

Pruning should be done as soon as possible after plantation reaches the pole stage. Pruning higher than 30 feet is not likely to prove economical. The best tools for pruning are pole saws up to 12 to 15 feet and above that light ladders and hand saws.

121. Bean, W. J.
1916. Stomata on the leaves of Sitka spruce. Quart. J. Forest. 10: 237-238.

It was noted that cone-bearing branches of Sitka spruce occasionally have stomata on the ventral leaf surface.

122. _______
1951. Trees and shrubs hardy in the British Isles. Vol. II, 664 pp., illus. London: John Murray.

123. Beaton, J. D., Moss, A., MacRae, I., and others.
1965. Observations on foliage nutrient content of several coniferous tree species in British Columbia. Forest. Chron. 41: 222-236.

In one set of Sitka spruce samples, concentrations of N, P, K, Ca, Mg, and S in current needles were 1.15, 0.18, 0.82, 0.42, 0.09, and 0.14 percent, respectively.

124. Becking, Rudy W.
1956. Die naturlichen Douglasien-Waldgesellschaften Washingtons and Oregons. [The forest association of Douglas-fir in its natural

range in Washington and Oregon.] Allg. Forst- und Jagdzeit. 127(2/3): 42-56, illus. [In German. English summary.]

Sitka spruce is a principal tree species in the Fog Belt (*gaultherieto-Psevdotsugetum sitchensetosum*) association. Indicator plants are listed for high and low sites.

125. Begley, C. D., and Howell, R.
1960. Air seasoning softwoods at stump. Forestry 33(2): 187-202.

Presents a brief statistical analysis of some practical results obtained from an experiment carried out with Sitka spruce thinnings between 1952 and 1957. Some savings in extraction costs can be expected from reduction in weight. Rate of seasoning differs with different seasons of felling and between peeled and unpeeled poles. Seasoning causes no serious deterioration in the quality of the timber for use as pit-props or boxwood. (Author's summary.)

126. Behrndt, G.
1961. Auftreten und Bekampfung der Sitkalaus im Fruhjahr 1961 im Privatwald des Weser-Ems-Raumes. [Occurrence and control of *Liosomaphis abietina* in private forests of the Weser-Ems region in spring 1961.] Allg. Forstzeitschrift 16(46): 659-661. [In German.]

In Sitka spruce plantations, Metasystox at 0.8 to 1 liter per hectare in 80 to 100 liters water, applied by knapsack sprayer to stands up to 3 meters tall, and to taller stands by helicopter, gave good control. Fogging with a lindane preparation was greatly hampered by wind and dew. Trees with stiff, blue-green foliage appeared to be more resistant than trees with green needles. In untreated areas, the outbreak was controlled by some disease. Costs of application are given.

127. Bejer-Petersen, B.
1962. Peak years and regulation of numbers in the aphid *Neomyzaphis abietina* (Walker). Oikos 13(1): 155-168, illus.

128. Belcher, Earl W., and Hitt, Robert G.
1965. Eastern tree seed laboratory twelfth annual report fiscal year 1965. USDA Forest Serv. Eastern Tree Seed Lab., 66 pp., illus.

Lists requirements for seed samples sent to the laboratory for testing; lists recommendations for testing; and contains sample forms and instructions for submitting samples. For Sitka spruce, stratification for 90 days is recommended; length of germination test is 20 days. A total of 122 days should be allowed for testing. Three-tenths of an ounce (10 g.) of seed should be submitted.

129. Bell, D. B.
1957. The relationship between height growth in conifers and the weather. J. Oxford Univ. Forest. Soc. 4(5): 11-14, illus.

130. Bell, W. L.
1958. Frost damage to Sitka spruce seedbeds, Pubble Nursery. Forest. Northern Ireland 1(4): 37-40.

Seedbeds suffer greatly from both early and late frosts at this nursery in northern Ireland. The degree of injury is closely related to density of sowing.

131. Benson, G. T.
1930. The trees and shrubs of western Oregon. Vol. II, 170 pp., illus. Dudley Herb. Contrib. Stanford: Stanford Univ. Press.

132. Benson, H. K., Thompson, T. G., and Wilson, G. S.
1923. The chemical utilization of wood in Washington. Univ. Wash. Eng. Exp. Sta. Ser. 19, 160 pp., illus.

133. Benzian, B.
1953. Nutrition problems in forest nurseries. Rothamsted [England] Exp. Sta. Rep. 1952: 42-45.

134. ________
1959. Nutrition problems in forest nurseries. J. Sci. Food Agr. 10(12): 637-644.

Results from many small-plot experiments in different nurseries and seasons, with Sitka spruce as the main test crop, have shown that it is safe to use commercial fertilizers (Nitro-Chalk, ammonium sulphate, superphosphate, and potassium chloride) in seedbeds and transplant beds. In short-term experiments, testing a range of composts and uncomposted organic materials, with and without additional fertilizer, effects were related to the major plant nutrients present. Interim results of several other experiments are discussed.

135. ________
1963. Comparison of Sitka spruce and Norway spruce in forest nurseries. Rothamsted [England] Exp. Sta. Rep. 1962: 54-55.

Results in nursery plots split between the two species were closely comparable during 1959-62, except for slight color differences caused by K deficiency. Both showed large and consistent height responses to N and P, and well-defined deficiencies were caused by lack of N, K, and Mg. In July 1962, however, after a cold, dry spring, Norway spruce transplants developed a severe red "scorch," associated with dressings of potassium chloride and ammonium sulphate whereas Sitka spruce on the same plots remained green and healthy.

136. ________
1966. Effects of nitrogen and potassium concentration in conifer seedlings on frost damage. Rothamsted [England] Exp. Sta. Rep. 1965: 58-59.

137. ________
1967. Manuring young conifers: experiments in some English nurseries. Fertilizer Soc. London Proc. 94: 5-37.

Manuring experiments dating from 1945 show that Sitka spruce and other conifers are sensitive to soil reaction and prefer acid soils. Soluble fertilizers were generally more efficient than compost on a poor, leached soil, but compost plus fertilizers was most satisfactory. Preliminary results from slow-release fertilizers were promising.

138. _______
1967. Picea sitchensis. Isobutylidene diurea for conifer seedlings. Rothamsted [England] Exp. Sta. Rep. 1966/67: 43-44, plus table.

Describes tests with seedlings in the nursery using IBDU, a slow-acting N fertilizer. Two sizes of granules were used. Heavy rains may have favored IBDU over other formulations; more testing is needed.

139. _______ and Bolton, J.
1966. Calcium as a plant nutrient for Sitka spruce. Rothamsted [England] Exp. Sta. Rep. 1965: 62.

140. _______ and Ogborn, J. E. A.
1955. Nutrition problems in forest nurseries. Rothamsted [England] Exp. Sta. Rep. 1954: 47-50.

Describes interim results of several experiments involving Sitka spruce.

141. _______ and Warren, R. G.
1956. Nutrition problems in forest nurseries: needle tip-burn. Rothamsted [England] Exp. Sta. Rep. 1955: 49-50.

A symptom known as "needle tip-burn" in Sitka spruce transplants was diagnosed as a copper deficiency.

142. _______ and Warren, R. G.
1956. Copper deficiency in Sitka spruce seedlings. Nature 178(4538): 864-865.

Describes nutritional experiments designed to cure tip-burn of Sitka spruce seedlings by application of a foliar spray of copper sulphate. Seedling heights increased nearly 50 percent on sprayed plots. In another experiment, a compost of bracken and hop-waste resulted in complete disappearance of deficiency symptoms. This result was attributed to copper content in the hop-waste, presumably from copper boilers used to boil the hops.

143. Benzian, Blanche.
1954. Nutrition problems in forest nurseries. Summary report for 1953. *In* Report on forest research for the year ended March 1954. Great Brit. Forest. Comm., pp. 38-50. London: H. M. Stationery Office.

144. _______
1956. Nutrition problems in forest nurseries. *In* Report on forest research for the year ended March 1955. Great Brit. Forest. Comm., pp. 71-72. London: H. M. Stationery Office.

Addition of phosphate to nursery soil resulted in substantial increase in height of Sitka spruce seedlings. Effects of soil treatments with formalin and chloropicrin are also discussed.

145. _______
1964. Nutrition experiments in forest nurseries: comparison of Sitka spruce and Norway spruce. *In* Report on forest research for the year ended March 1963. Great Brit. Forest Comm., pp. 87-88. London: H. M. Stationery Office.

146. _______
1965. Nutrition experiments in forest nurseries: potassium manuring of Sitka spruce seedlings. *In* Report on forest research for the year ended March 1964. Great Brit. Forest. Comm., pp. 87-88. London: H. M. Stationery Office.

147. _______
1965. Experiments on nutrition problems in forest nurseries. 2 vols. Great Brit. Forest. Comm. Bull. 37.

Reports on work carried out between 1945 and 1962 by a joint research effort between staff of the Rothamsted Experiment Station and the research branch of the Forestry Commission. Contains many results of experiments on the nutrition of many conifer species including Sitka spruce. Volume II gives tables relating to numerous experiments on the nutrition of various conifers including Sitka spruce.

148. _______, Bolton, J., and Mattingly, G. E. G.
1965. Nutrition experiments in forest nurseries: slow-release fertilizers for conifer seedlings. Rothamsted [England] Exp. Sta. Rep. 1964: 55-57.

Describes effects of phosphorus and potassium fertilizers on 1-year-old seedlings.

149. _______, Bolton, J., and Mattingly, G. E. G.
1966. Nutrition experiments in forest nurseries: slow-release fertilizers for conifer seedlings. *In* Report on forest research for the year ended March 1965. Great Brit. Forest. Comm., pp. 88-89. London: H. M. Stationery Office.

150. _______, Bolton, J., and Mattingly, G. E. G.
1967. Nutrition experiments in forest nurseries. *In* Report on forest research for the year ended March 1967. Great Brit. Forest. Comm., pp. 133-134. London: H. M. Stationery Office.

Describes results of a slow nitrogen fertilizer, isobutlidenediurea, on Sitka spruce seedlings in a forest nursery and continuation of an experiment comparing effects of potassium metaphosphate, potassic superphosphate, and potassium dihydrogen phosphate on growth of Sitka spruce seedlings.

151. _______ and Freeman, S. C. R.
1967. Effect of "late-season" N and K top dressings applied to conifer seedlings and transplants, on nutrient concentrations in the whole plant and on growth after transplanting. *In* Report on forest research for the year ended March 1967. Great Brit. Forest. Comm., pp. 135-140. London: H. M. Stationery Office.

Dressing applied in September increased nutrient concentration at a stage when growth had nearly ceased. For seedlings of Sitka spruce and western hemlock, susceptibility to autumn frost was decreased by both N and K. After lining out, bud development was slightly accelerated and height growth at the end of the season slightly increased for most species.

152. Bergemann, J.
1955. Die Mykorrhiza-Ausbildung einiger Koniferen-Arten in verschiedenen Boden. [The development of mycorrhizae of some conifers in different soils.] Z. Weltforstwirt. 18(5/6): 184-202, illus. [In German. English summary.]

Compares growth of mycorrhizae on six conifer species, including Sitka spruce, grown in pot cultures with three soil types.

153. Berner, E., Jr.
1950. Chlorophyll production by young coniferous plants at different light intensities. Arbok, Univ. Bergen, 1949(1 Hefte), Naturvitnskapelig Rekke 6, 32 pp.

154. Berntsen, Carl M.
1954. Some results of chemical debarking on Sitka spruce, western hemlock, and red alder. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Res. Note 104, 7 pp., illus.

Sodium arsenite painted on a sap-peeled girdle on spruce and hemlock during the growing season loosened bark sufficiently to allow peeling of large sections the following year. Breakage during felling was more severe for treated trees.

155. ________
1955. Seedling distribution on a spruce-hemlock clearcut. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Res. Note 119, 7 pp., illus.

After clearcutting of a spruce-hemlock stand (Cascade Head Experimental Forest, Oregon), 160-milacre regeneration plots were established with five seedbed types: (1) rotten and decomposing wood, (2) mineral soil, (3) surface covered with slash, (4) heavy vegetation, (5) swampy ground. Examination 7 years after clearcutting showed spruce regeneration on 53 percent and hemlock on 44 percent of the plots. Best conditions were provided by (1) (97 percent stocked) and (2) (83 percent stocked); (5) was unstocked. There were more than twice as many seedlings on plots with a north aspect as on those with a south aspect. Accumulations of slash were found to retard growth of trees and other vegetation.

156. ________
1958. A look at red alder--pure and in mixture with conifers. Soc. Amer. Forest. Proc. 1958: 157-158.

157. ________
1960. Planting Sitka spruce and Douglas-fir on decayed wood in coastal Oregon. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Res. Note 197, 5 pp., illus.

Four-year survival of Douglas-fir and Sitka spruce on both north and south aspects was the same whether seedlings were planted on mineral soil or on naturally occurring decayed wood. Height growth was as good (or better) on decayed wood as on soil. The decayed wood held moisture late into the summer, was a good medium for root growth, and discouraged competition from other plants. Planting on decayed wood in coastal Oregon is recommended where growing-season precipitation averages at least 10 inches.

158. ________
1961. Growth and development of red alder compared with conifers in 30-year-old stands. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Res. Pap. 38, 20 pp., illus.

To help provide basic growth data for red alder and associated species, experimental plots were established during the period 1935-37 on the Cascade Head Experimental Forest, near the Oregon coast. Treatments were designed to illustrate potential growth of red alder as it occurs in pure stands at an early age. Growth of these alder stands was compared with growth of a stand thinned to pure conifer--Douglas-fir, Sitka spruce, and western hemlock.

159. Berry, James Berthold.
1964. Western forest trees; a guide to the identification of trees and woods for students, teachers, farmers, and woodsmen. 212 pp., illus. New York: Dover Publications.

160. Betts, H. S.
1929. The strength of North American woods. U.S. Dep. Agr. Misc. Pub. 46, 18 pp.

161. ________
1945. American woods: Sitka spruce. U.S. Dep. Agr. Forest Serv., 5 pp.

Gives briefly the description, nomenclature, distribution and growth, supply, production, properties, and principal uses of Sitka spruce.

162. Betts, Harold S.
1919. Timber: its strength, seasoning, and grading. 234 pp., illus. New York and London: McGraw-Hill Book Co.

163. Bevan, D.
1966. The green spruce aphis *Elatobium* (*Neomyzaphis*) *abietinum* (Walker) Scot. Forest. 20(3): 193-201, illus.

164. Bever, Dale N.
1954. Evaluation of factors affecting natural reproduction of forest trees in central western Oregon. Oreg. State Board Forest. Res. Bull. 3, 49 pp., illus.

165. Bialobok, Stefan, and Chylarecki, Henryk.
1965. Badania nad upwawa drzew pochodzenia w Polsee w warunkach srodowiska lesnego. [Investigations on the cultivation of exotic trees in forest conditions in Poland.] Arboretum Kornicki, Pozan 10: 211-277 plus 2 tables, 4 maps. [In Slovak. English summary.]

166. Bier, J. E.
1946. The relation of research in forest pathology to the utilization of overmature timber. The significance of brown pocket rot in Sitka spruce on the Queen Charlotte Islands. Brit. Columbia Lumberman 30(6): 54-55, 74, illus.

167. ________ and Foster, R. E.
1946. The relation of research in forest pathology to the preparation of forest inventories. I. Suggested aids for cruising overmature

stands of Sitka spruce on the Queen Charlotte Islands. Brit. Columbia Lumberman 30(4): 38-40, 64, illus.

168. _______ and Foster, R. E.
1946. The relation of research in forest pathology to the utilization of overmature timber. II. Significance of conk rot in Sitka spruce on Queen Charlotte Islands. Brit. Columbia Lumberman 30(5): 51-52, 65, illus.

169. _______ and Foster, R. E.
1946. The relation of research in forest pathology to the preparation of forest inventories. 2. The possibility of obtaining net volumes by grade when cruising overmature stands of Sitka spruce on the Queen Charlotte Islands. Brit. Columbia Lumberman 30(7): 52-53, 66, 68, illus.

170. _______, Foster, R. E., and Salisbury, P. J.
1946. Studies in forest pathology. IV. Decay of Sitka spruce on the Queen Charlotte Islands. Can. Dep. Agr. Tech. Bull. 56, 35 pp. plus 10 plates.

Reviews previous investigations and describes loss from decay, with particular emphasis on a disease known locally as pocket rot.

171. _______ and Nobles, Mildred K.
1946. Brown pocket rot of Sitka spruce. Can. J. Res. 24C(4): 115-120, illus.

A brown pocket rot of Sitka spruce occurs in stands on the Queen Charlotte Islands, B.C. The decay, the sporophore associated with it, and the cultural characters of the fungus are described. The causal fungus is described as *Lentinus kauffmanii* sp. n. by Dr. Alexander H. Smith, Univ. of Mich. (Author's summary.)

172. Binkley, Virgil W.
1965. Economics and design of a radio-controlled skyline yarding system. Pacific Northwest Forest & Range Exp. Sta. USDA Forest Serv. Res. Pap. PNW-25, 30 pp., illus.

An analysis of factors affecting time and costs of skyline logging in mature Sitka spruce and western hemlock on the Cascade Head Experimental Forest near Otis, Oreg.

173. Binns, W. O.
1961. Forest soils research in Scotland. *In* Report on forest research for the year ended March 1960. Great Brit. Forest. Comm., pp. 93-94. London: H. M. Stationery Office.

174. _______
1962. Some aspects of peat at a substrate for tree growth. Irish Forest. 19(1): 32-55.

Studies at 12 deep peat sites in Scotland and northern England show that needs of Sitka spruce and other conifers for additional P and K may be estimated from the total P and K contents of the upper layers of the peat.

175. _______
1965. Amelioration of forest sites. *In* Report on forest research for the year ended March 1964. Great Brit. Forest. Comm., pp. 21-22. London: H. M. Stationery Office.

176. _______
1966. Current fertilizer research in the forestry commission. Sixth Discussion Meeting, Edinburgh, Rep., 7 to 9 January. Forestry (Suppl.) 39: 60-64.

Pole-stage experiments have suggested that Sitka spruce is likely to respond to phosphorus on some mineral soils. Sitka spruce has not responded to nitrogen, though other species have. Trials on near-mature crops, following up Scandinavian work, will be started soon. (From author's summary.)

177. _______ and Atterson, J.
1967. Nutrition of forest crops. *In* Report on forest research for the year ended March 1967. Great Brit. Forest. Comm., pp. 48-53. London: H. M. Stationery Office.

Describes results of a demonstration of nutrient deficiencies on Sitka spruce and lodgepole pine. Describes 1966 results on permanent foliage sampling plots established to measure variations of nutrient concentrations in foliage.

178. _______ and Coates, A. E.
1966. Manuring of pole-stage crops. *In* Report on forest research for the year ended March 1965. Great Brit. Forest. Comm., pp. 25-26. London: H. M. Stationery Office.

Describes fertilizer experiments in south and central England and Wales.

179. _______ and Grayson, A. J.
1967. Fertilization of established crops: prospects in Britain. Scot. Forest. 21(2): 81-98.

Application of 88 pounds phosphorus per acre to three pole-stage Sitka spruce stands in Wales resulted in growth increases of 11 to 18 percent over a 7-year measurement period. Experiments on three other Welsh sites failed to increase growth because the primary limiting factor was poor drainage. In general, the Welsh work on pole-stage Sitka spruce indicates that nitrogen can be omitted over a wide range of sites.

180. Bishop, Daniel M., and Stevens, Mervin E.
1964. Landslides on logged areas in southeast Alaska. Northern Forest Exp. Sta. USDA Forest Serv. Res. Pap. NOR-1, 18 pp., illus.

Describes and tentatively analyzes landslides on timbered slopes of mountainous southeast Alaska. Vegetation below timberline is mainly western hemlock and Sitka spruce. Recent large-scale clearcut logging of timber has accelerated debris avalanches and flows on steep slopes.

181. Bjarnason, Hakon.
1951. A brief report on the reforestation of Iceland. Skograekt Rikisins. Reykjavik, 14 pp. [In English.]

Between 1899 and 1913, seed and seedlings of different species were introduced into Iceland and planted in the south, north, and northwest of the country. The growth of these species, including Sitka spruce, is discussed.

182. ______
1965. Um gródurskilyrdi og skógraekt. [Growing conditions and forestry.] Arsrit Skógraektarf. Íslands 1965: 5-12. [In Icelandic.]

183. ______
1967. Ferd til Skotlands og Bretlands 1966. [A short trip to Scotland and England in the spring 1966.] Ársrit Skógraektarf. Íslands 1967: 26-33, illus. [In Icelandic. English summary.]

184. Blair, Sir James Hunter.
1946. Frost damage to woodlands on Blairquhan Estate in April 1945. Scot. Forest. J. 60(1): 38-43.

Presents notes on damage caused by a severe frost (16° F.) following a mild winter and spring. The most extensive damage occurred in plantations of Sitka spruce. Damage varied from complete destruction to crippling; though most severe in frost hollows, it also occurred on sloping ground and even on knolls. Damage was most severe in the young plantations but is also apparent in trees up to 40 feet high and 20 years old. Effects of frost on several other species are described.

185. Blanc, L.
1961. Valeur papetiere, pour papier kraft, des bois resineux exotiques. [The suitability of exotic conifers for kraft paper pulp.] Rev. Forest. Franc. 13(8/9): 558-566, illus. [In French.]

Describes small-scale test of kraft paper made from the pulp of various exotics grown in France, including Sitka spruce, after various degrees of refinement, with graphs illustrating strength properties.

186. Bletchly, J. D., and Taylor, Jean M.
1964. Investigations on the susceptibility of home-grown Sitka spruce (*Picea sitchensis*) to attack by the common furniture beetle (*Anobium punctatum* Deg.). J. Inst. Wood Sci. 12 (May): 29-43, illus.

Describes the effect of the chemical composition and compression wood of Sitka spruce on the development of larvae inserted into blocks.

187. ______ and White, M. G.
1962. Significance and control of attack by the ambrosia beetle (*Trypodendron lineatum*) (Oliv.) (Col Scolytidae) in Argyllshire forest. Forestry 35(2): 139-163 plus 4 photos.

Damage to saw logs of Sitka spruce and other softwood species in Argyllshire forest by pinhole borers was studied and control measures were developed. Most damage was by the ambrosia beetle. Attack begins in April, reaches a peak in May, then declines rapidly and becomes of negligible importance after August. Trees felled between November and January are more susceptible, but few logs left at stump are attacked. Damage is much more widespread in logs stacked in the forests or at the mill. Control methods are discussed.

188. Blew, J. O., Roth, H. G., and Davidson, H. L.
1967. Preservative retention and distribution in several western conifers. Amer. Wood Preservers' Ass., 12 pp., illus.

Preservative retention of Sitka spruce from Oregon and Alaska was erratic but reasonably good. Spruce grown in Oregon performed better than that grown in Alaska.

189. Blokhuis, J. L. W.
1955. Gebruik van kunstmest in de bossen. [Use of artificial fertilizers in forestry.] Ned. Boschb.-Tijdschr. 27(7): 178-181. [In Dutch.]

Reports further progress on plots established in 1933-36. The favorable effect of Ca treatment on oak, Norway and Sitka spruce, and Douglas-fir, and its bad effect on Japanese larch were still visible.

190. Boe, K. N.
1966. Windfall after experimental cuttings in old-growth redwoods. Soc. Amer. Forest. Proc. 1965: 59-63.

191. Bollen, W. B., and Wright, Ernest.
1961. Microbes and nitrates in soils from virgin and young-growth forests. Can. J. Microbiol. 7: 785-792.

Penicillium spp. predominated in samples of forest soils except occasionally at depths of 3 inches, when *Mucor* and *Aspergillus* spp. were sometimes more abundant. Incubation for 30 days at 28° C. and 40 percent moisture capacity frequently increased the percent of *Mucor* as well as of *Penicillium* spp. *Mucor* spp. were consistently more predominant in soils associated with alder than in other coastal soils. The greatest concentration of N as NO_3 in unincubated soils was found in a young red alder stand. Samples of soil from stands of virgin coastal redwood showed no NO_3-N. Soils from stands of virgin Sitka spruce, however, showed considerable NO_3 content, which increased markedly with incubation. With few exceptions, bacteria and actinomycetes were most numerous in the F soil horizon. Incubation greatly increased these populations in most soils. (From author's summary.)

192. Bollen, Walter B., Chen, Chi-Sin, Lu, Kuo C., and Tarrant, Robert F.
1967. Influence of red alder on fertility of a forest soil, microbial and chemical effects. Forest Res. Lab. Oreg. State Univ. Res. Bull. 12, 61 pp., illus.

Describes microbial and chemical characteristics of the soil under adjoining stands of conifer (including Sitka spruce), alder, and mixed alder-conifer.

193. Bones, James T.
1961. Estimating spruce and hemlock D.B.H. from stump diameter. USDA Forest Serv. Northern Forest Exp. Sta. Tech. Note 51, 2 pp.

194. ________
1962. Relating outside- to inside-bark diameter at top of first 16-foot log for southeast Alaska Timber. USDA Forest Serv. Northern Forest Exp. Sta. Tech. Note 52, 2 pp.

Contains a table showing conversion factors for Sitka spruce, western hemlock, Alaska-cedar, and western redcedar, with information on the number and dimensions of sample trees measured.

195. ________
1963. Wood processing in Alaska, 1961. Northern Forest Exp. Sta. USDA Forest Serv. Resource Bull. NOR-1, 14 pp., illus.

Findings of a complete canvass of the primary wood processors of Alaska in 1961. Sitka spruce provided 46 percent of the volume of logs consumed by Alaskan wood processors.

196. ________
1963. Volume distribution by log position for southeast Alaska trees. Northern Forest Exp. Sta. USDA Forest Serv. Res. Note NOR-1, 2 pp.

197. Bongard, Heinrich G.
1833. Observations sur la vegetation de l'ile de Sitcha. [Observations of the vegetation of Sitka Island.] St. Petersburg Acad. Sci. Mem., Ser. 6, Sci. Math. Phys. Nat. 2: 119-177. [In French.]

Includes botanical description of Sitka spruce, page 164. Referred to as *Pinus sitchensis*.

198. Booth, H. A.
1940. The growing of Sitka spruce for pitprops. Quart. J. Forest. 34: 72-74.

Measurements of two Sitka spruce stands about 35 years old showed 1,150 and 1,100 poles per acre, with a volume inside bark of 3,929 and 3,817 cubic feet, respectively, corresponding to nearly 50,000 lineal feet of props per acre. The two stands were underthinned, and it is suggested that deliberate underthinning might be used to produce a large number of stems per acre and to improve quality resulting from closer growth rings. Sitka spruce is tolerant of poor soils and should be a desirable tree to grow on a short rotation for pitprops, if the site is within 50 miles of a colliery.

199. Borchers.
1952. Folgerungen aus den bisherigen Anbauergebnissen mit fremdländischen Holzarten im Gebiet des Landes Niedersachsen für die künflige waldbauliche Planung. [Conclusions to be drawn for future silvicultural planning from the results so far obtained in trials of exotic tree species in Niedersachsen.] Mitt. Deut. Dendrol. Ges. (Jb. 1951/52) 57: 68-81. [In German. English summary.]

Describes several plantations of various species, including Sitka spruce.

200. Bornebusch, C. H.
1937. Sommerplantning af Naaletraeer. [Summer planting of conifers.] Forstl. Forsøgsv. Danmark 14(2): 97-132, illus. [In Danish.]

201. ________
1941. Fremmede Naaletraeer paa Søllestedgaard revision; 1940. [Exotic coniferous trees on Søllestedgaard estate revised in 1940.] Forstl. Forsøgsv. Danmark 15(5), 32 pp. [In Danish. English summary.]

202. ———
1944. Godskning af planteskoler. [Manuring of nurseries.] Dansk Skovforen. Tidsskr. 29(2): 49-55. [In Danish.]

203. ———
1944. Opbevaring af Rødgran-og Sitkagranfrø. Foreløbige Forsøgsresultater. [Storage of Norway and Sitka spruce seed. Preliminary results of experiments.] Dansk Skovforen. Tidsskr. 29: 257-263, illus. [In Danish.]

Describes tests of seed storage. Best results came from seed stored at 4- to 8-percent moisture content in a dark, frost-free cellar. Such seed retained its viability unchanged for 2 years.

204. ———
1946. Sitka-Hvidgran-Bastarden. [The Sitka X white spruce hybrid.] Dansk Skovforen. Tidsskr. 31: 42-46. [In Danish.]

Sitka X white spruce hybrids are said to have existed in the Danish Forest Research Organization's nurseries as long ago as the end of the last century and to have been shorter branched but not inferior to pure Sitka in growth. Performance in relation to seed origin is discussed.

205. ——— and Ladefoged, Kjeld.
1940. Hvidgranens og Sitkagranens Dødelighed i Hede-og Klitplantager i 1938 og 1939. [Cold damage to white spruce and Sitka spruce in heath and dune plantations during 1938 and 1939.] Forstl. Forsøgsv. Danmark 15(4): 209-232, illus. [In Danish.]

During the winter of 1938-39, severe frost damage was observed on white spruce, Sitka spruce, and Douglas-fir. This was the result of an unusually high temperature in March (6.5° to 10° C. above the normal temperature) that was followed by very low April temperature--3.8° C. below zero. The cambial zone had commenced activity previous to the April frost and was severely injured.

206. Børset, O.
1967. Om bruk av eksotiske treslag i Norge. [The use of exotic trees in Norway.] Skogbrukets Skogind. Forsk. (Oslo), 18 pp. [In Norwegian.]

Chiefly reviews literature outlining the history of trials of exotics in Norway since 1739. The only exotic species of economic and practical importance is Sitka spruce.

207. Borthwick, A. W.
1909. Frost canker of *Picea sitchensis* (Trautv. et Mey.), the Menzies spruce. Roy. Bot. Gard. Notes (Edinburgh) 4(20): 263-265 plus plate LI.

208. Boullard, B.
1964. L'elagage des resineux: un commentaire s'appuyant sur des travaux recents. [The pruning of conifers: a commentary based on recent work.] Foret Privee, Paris 37: 5-17, illus. [In French.]

Supplies a practical guide to pruning, with commentary on experience with several conifer species, including Sitka spruce.

209. Boullard, Bernard.
1961. Etude d'une attaque '1' *Armillariella mellea*' (Vahl) Quel. sur l'epicea de Sitka: hiologie du parasite, moyens de lutte. [An attack of *Armillaria mellea* on Sitka spruce: biology of the parasite and control methods.] Rev. Forest Franc. 13(1): 16-24, illus. [In French.]

Describes an attack on a 15-year-old plantation of Sitka spruce in Normandy and discusses possible control measures; also briefly reviews the literature on the biology of the fungus.

210. Bowers, N. A.
1918. Filling the allies' rush order for airplane spruce. Eng. News-Rec. 81: 1023-1031.

211. Bowers, Nathan A.
1942. Cone bearing trees of the Pacific Coast. 169 pp., illus. New York and London: Whittlesey House, div. of McGraw-Hill Book Co.

Description, distribution, and general information about Sitka spruce.

212. ______
1956. Cone-bearing trees of the Pacific Coast. Ed. 5(rev.), 169 pp., illus. Palo Alto, Calif.: Pacific Books.

213. Bowman, Paul W.
1934. Pollen analysis of Kodiak bogs. Ecology 15(2): 97-100.

214. Boyce, J. S.
1923. Decays and discolorations in airplane woods. U.S. Dep. Agr. Bull. 1128, 51 pp., illus.

Discusses general wood specifications and the significance of many typical discolorations and decays in regard to the suitability of timber for aircraft construction. Sitka spruce is described as the most important wood used for this purpose.

215. ______
1929. Deterioration of wind-thrown timber on the Olympic Peninsula, Washington. U.S. Dep. Agr. Tech. Bull. 104, 28 pp., illus.

Following the January 29, 1921, windstorm, Sitka spruce deteriorated less rapidly than western hemlock and Pacific silver fir, but more rapidly than Douglas-fir and western redcedar. Most of the loss for the first three seasons was due to ambrosia beetles and blue stain in the sapwood. Decay became more important after the fourth season, and by the summer of 1926, the sapwood of all species had been virtually destroyed. Considerable Sitka spruce heartwood had been rotted. By the summer of 1926, total loss in Sitka spruce was 46.3 percent of the board-foot volume and 41.7 percent of the cubic-foot volume.

216. _______
1930. Decay in Pacific Northwest conifers. Yale Univ. Osborn Bot. Lab. Bull. 1, 51 pp., illus.

Presents information in a nontechnical style for landowners, lumbermen, foresters, and forestry students, enabling them to recognize the decays of commercially important softwoods in the Pacific Northwest and apply this knowledge in cruising and scaling. (From author's explanation.)

217. Boyce, John S.
1961. Forest pathology. Ed. 3, 572 pp., illus. New York: McGraw-Hill Book Co.

218. Bradley, R. T.
1967. Thinning control in British woodlands. Great Brit. Forest. Comm. Booklet 17, 32 pp., illus.

Provides a guide to the volume to be removed in thinning of pure even-aged stands or, with suitable modifications, in thinning of woods of mixed species and/or uneven age. Sitka spruce is included.

219. _______
1967. Thinning experiments and the application of research findings in Britain. Fourteenth IUFRO-Kongress Pap., Munchen. 9(sect. 25, no. 6): 242-249.

Discusses thinning research techniques and their limitations and the current status of thinning research with Sitka spruce in Britain.

220. _______, Christie, J. M., and Johnston, D. R.
1966. Forest management tables. Great Brit. Forest. Comm. Bull. 16, 218 pp., illus.

Includes general yield class curves, production class curves, thinning control tables, production forecast tables, and normal yield tables for Sitka spruce. Supplement No. 1, published March 1967, includes normal yield tables for yield classes 80 and 60.

221. _______, Christie, J. M., and MacKenzie, A. M.
1962. Mensuration. *In* Report on forest research for the year ended March 1961. Great Brit. Forest. Comm., pp. 65-69. London: H. M. Stationery Office.

222. Brandstrom, Axel.
1918. Possibilities of future airplane spruce production in the Pacific Northwest. Univ. Wash., Forest. Club Annu. 6: 15.

223. Brayshaw, T. C.
1960. Key to the native trees of Canada. Can. Dep. Forest. Bull. 125, 43 pp., illus.

224. Brazier, J. D.
1967. Timber improvement. I. A study of the variation in the wood characteristics in the young Sitka spruce. Forestry 40(2): 117-128.

A study of variation in some wood characteristics in Sitka spruce indicated a similar pattern of within-tree variation in density, tracheid length, and grain inclination for both selected and average final crop trees. There was an appreciable variation in these characteristics between trees of comparable ages, indicating the potential for improvement by selection. There was a reduction in density and some increase in grain inclination, but no difference in tracheid length in vigorous compared to average-growth trees at comparable ages. There was no evidence that selection for above-average density would have an adverse effect on tracheid length; it tends to favor trees having a high minimum wood density and, to a limited extent, wood with narrow cells. (From author's summary.)

225. Briegleb, P. A.
1940. Spruce-hemlock forest shows prodigious growth. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Res. Note 31: 1-2.

Data from 11 plots established on the Cascade Head Experimental Forest near Otis, Oreg., showed that at age 89 a stand of spruce-hemlock had a volume of 22,530 cubic feet or 262 cords per acre. Species composition was 54 percent hemlock, 45 percent Sitka spruce, and 1 percent Douglas-fir.

226. Brind, Janet E.
1965. Some studies of the effect of partial sterilization on the soil micropopulation. *In* Blanche Benzian (ed.), Experiments on nutrition problems in forest nurseries. Great Brit. Forest. Comm. Bull. 37(1): 206-209.

227. Brit, G. de, and O'Carroll, N.
1967. Group dying of Sitka spruce, and its relationship with *Rhizina undulata* and fire sites. Fourteenth Congr. Int. Union Forest. Res. Organ. Proc. (Munich) Part V. 24: 494-500.

228. British Columbia Forest Service.
1936. Volume, yield, and stand tables for some of the principal timber species of British Columbia. Brit. Columbia Forest Serv., 53 pp., illus.

229. ______
1948. Growth studies. Brit. Columbia Forest Serv. Rep. 1947: 17-18.

For the purpose of determining the total age of older trees when a ring count is made at a known height above the ground, an analysis was made of hemlock, spruce, and cedar seedlings growing on cutover areas. The results are given in a table showing total height in feet at ages from 1 to 10 years for hemlock and spruce on both good and poor soils, and for western redcedar on average sites.

230. ______
1949. Volume tables. Brit. Columbia Forest Serv. Rep. 1948: 11-17.

Site-class volume tables for Douglas-fir, western hemlock, western redcedar, coast balsam fir, and Sitka spruce, in British Columbia.

231. ______
1950. Number of years necessary to grow to height of ring count. Brit. Columbia Forest Serv. Rep. 1949: 31.

232. ________
1962. Sitka spruce spacing trial. Brit. Columbia Forest Serv. Forest Res. Rev. 1961/62: 20.

Describes establishment of a spacing trial begun in 1961 with spacings of 6 by 6, 9 by 9, 12 by 12, and 15 by 15 feet.

233. ________
1962. Basic taper curves for the commercial softwood species of British Columbia. Brit. Columbia Forest Serv., unpaged, 21 figs.

234. ________
1966. Butt-taper tables for coastal tree species. Brit. Columbia Forest Serv. Forest Survey Note 7, 12 pp., illus.

Includes a butt-taper table for Sitka spruce from 0.5 to 5.0 feet above ground level.

235. ________
1966. Net volume (loss) factors. Brit. Columbia Forest Serv. Forest Survey Note 8, 80 pp., illus.

Presents factors used to reduce gross volumes (reported at close, intermediate, or rough utilization standards) by decay only or by a combination of decay, waste, or breakage to arrive at a realistic net volume.

236. British Standards Institution.
1955. Nomenclature of commercial timbers including sources of supply. 144 pp. London: Waterlow & Sons.

237. Britton, Nathaniel Lord, and Shafer, John Adolph.
1908. North American trees; being descriptions and illustrations of the trees growing independently of cultivation in North America, north of Mexico and the West Indies. 894 pp., illus. New York: Henry Holt & Co.

238. Brockman, C. Frank.
1949. Trees of Mount Rainier National Park. 49 pp., illus. Seattle: Univ. Wash. Press.

Sitka spruce is of such limited occurrence in the park it is unlikely that visitors will find it here. A few isolated specimens have been reported at low elevations in the North Puyallup and Carbon River valleys near the west boundary.

239. Broughton, J. A. H.
1962. Properties of 30- to 37-year-old Sitka spruce timber. Great Brit. Dep. Sci. & Ind. Res. Forest Prod. Res. Bull. 48, 24 pp., illus.

A general account of studies on the fundamental properties of Sitka spruce from many sites in the United Kingdom. Outlines methods of field sampling, laboratory testing, and examining the properties in relation to end use.

240. Brown, H. P., and Panshin, A. J.
1934. Identification of the commercial timbers of the United States. 223 pp., illus. New York and London: McGraw-Hill Book Co.

241. _______, Panshin, A. J., and Forsaith, C. C.
1949. Textbook of wood technology. Vol. I, 652 pp., illus. New York: McGraw-Hill Book Co.

242. Brown, J. M. B.
1965. Forest ecology: fall-off in growth of Sitka spruce in South Wales. *In* Report on forest research for the year ended March 1964. Great Brit. Forest. Comm., p. 47. London: H. M. Stationery Office.

243. _______ and Bovan, D.
1966. The great spruce bark beetle, *Dendroctonus micans,* in northwest Europe. Great Brit. Forest. Comm. Bull. 38, 41 pp. plus 34 plates.

Describes the life history of the insect. *D. micans* attacks several spruces, but Sitka spruce appears more susceptible than Norway spruce. Consequently, outbreaks occur mostly where Sitka spruce has been widely planted (Jutland, northwest Schleswig-Holstein).

244. Brown, James, and Nisbit, John.
1894. The forester. Vol. 1, 629 pp., illus. Edinburgh and London: William Blackwood & Sons.

245. Brown, L. L.
1921. Canadian Sitka spruce: its mechanical and physical properties. Can. Dep. Int. Forest. Br. Bull. 71, 39 pp.

Sitka spruce from the Queen Charlotte Islands is stronger than that grown on the mainland in southern British Columbia by approximately 3 to 14 percent. Density is not readily apparent because of the similar color of springwood and summerwood and the gradual transition from one to the other. Strength increases from the pith outward. Strength of small, clear pieces of Sitka spruce increases very rapidly when dried below the fiber-saturation point, which is about 31 percent moisture, based on dry weight of the wood. Increase in moisture above the fiber-saturation point does not influence the strength of the wood. Curves are presented by which the strength of any piece of clear Sitka spruce can be closely estimated from its density.

246. Brown, W., Falkehag, S. I., and Cowling, E. B.
1967. Molecular size distribution of lignin in wood. Nature 214(5086): 410-411, illus.

247. Browne, J. E.
1962. Standard cubic-foot volume tables for the commercial tree species of British Columbia, 1962. Brit. Columbia Forest Serv., 107 pp.

Presents 24 cubic-foot volume tables for 15 commercial tree species, including tables for immature and mature Sitka spruce.

248. Bruce, David, and Court, Arnold.
1945. Trees for the Aleutians. Geogr. Rev. 35(3): 418-423.

Briefly describes the climate of the Aleutian Islands, the slow spread of forest on Kodiak Island, and the attempts of the American army to plant trees in the Aleutians during the war. The only species which survived after a year was Sitka spruce.

249. Bruce, Mason.
1960. National Forest in Alaska. J. Forest. 58: 437-442.

General description of Sitka spruce stands in Alaska. Sitka spruce makes up 29 percent of the gross timber volume.

250. Brückner, E.
1952. Anbauversuche mit fremdlandischen Holzarten in Wuchsgebiet des Erzgebirges. [Trials with exotics in Erzgebirge region.] Wald 2(2): 55-57. [In German.]

251. Bryan, J.
1963. Pulp and paper: effect of fibre form on pulp properties. Great Brit. Dir. Forest. Prod. Res. Rep., Princes Risborough 1962: 40-42.

Pulp was prepared from each of 21 annual rings in a single internode of a Sitka spruce tree. Preliminary results of tests are discussed.

252. _______ and Doman, L. S.
1940. Fire resistance--the comparative resistance to fire of various species of timber. Wood 5(1): 19-23, illus.

Sitka spruce was tested along with 77 other species for inflammability, flame penetration, rate of burning, fire resistance, and the results were compared. Fire resistance was found to be "low."

253. _______ and Pearson, F. G. O.
1955. The quality of Sitka spruce grown in Great Britain. Empire Forest Rev. 34(2): 144-153, illus.

An account of an investigation into the "quality," as measured by specific gravity, of Sitka spruce from six plantations in Great Britain. Within the tree, specific gravity tended to be high near the pith, fell to a minimum about 15-20 rings from the pith, and then increased steadily to the cambium layer. This pattern occurred in every tree examined from each site. Strength in compression was generally proportional to specific gravity, with the addition of a superimposed trend of increasing specific strength from pith to cambium, so that the high-density material at the pith did not have correspondingly high strength. The specific gravity of the wood accruing at a uniform age of 30 years is directly related to the latitude of growth, the heaviest wood being from trees in southern England and the lightest from trees in northern Scotland. (From author's summary.)

254. Bryden, A. W.
1922. Sizes and grades of Pacific coast woods. Timberman, April, pp. 43-45.

255. Buchanan, T. S.
1940. Fungi-causing decay in wind-thrown northwest conifers. J. Forest. 38: 276-281.

256. ______
1948. *Poria weirii*: Its occurrence and behavior on species other than cedars. Northwest Sci. 22(1): 7-12.

The fungus also causes loss to Douglas-fir, western hemlock, and has been found on true firs, Sitka spruce, and ponderosa pine.

257. ______ and Englerth, G. H.
1940. Decay and other volume losses in windthrown timber on the Olympic Peninsula, Washington. U.S. Dep. Agr. Tech. Bull. 733, 29 pp., illus.

Contains detailed tree-volume-loss data for Sitka spruce and other conifer species and discusses loss and salvage. Sitka spruce logs are no longer merchantable 15 years after being windthrown, regardless of size.

258. Buckland, D. C., Molnar, A. C., and Wallis, G. W.
1954. Yellow laminated root rot of Douglas-fir. Can. J. Bot. 32: 69-81.

Describes a variety of *Poria weirii* that attacks several species of conifers, including Sitka spruce, in British Columbia.

259. Bunnell, F. L.
1965. Variations in pollen morphology of selected conifers native to British Columbia. 60 pp. (B.S. in Forestry thesis on file at Univ. Brit. Columbia.)

Describes Sitka spruce pollen grains. There was significant variation in pollen morphology between certain of the sample trees.

260. Burley, J.
1964. Effect of gibberellic acid on seed germination of Sitka spruce. Forest Sci. 10: 206-208.

Concentrations of 0.1, 1.0, and 10 p.p.m. compared with distilled water caused no significant differences in germination rate or capacity. A solution of 100 p.p.m. significantly reduced germinative capacity at 35 days. A table summarizes the conflicting results obtained by 14 authors on the effects of gibberellin on the germination rate and capacity of 15 other conifers.

261. Burley, Jeffery.
1965. Genetic variation in *Picea sitchensis* (Bong.) Carr. 203 pp., illus. Ph.D. thesis, Yale Univ. Ann Arbor: Univ. Microfilms, Inc. (Diss. Abstr. 26(4): 1847.)

262. ______
1965. Genetic variation in *Picea sitchensis* (Bong.) Carr. A literature review. Commonwealth Forest Rev. 44(1): 47-59.

Describes the nature and importance of genetic variation in forest trees, with particular reference to Sitka spruce. The literature referring to patterns and nomenclature of variation is reviewed and it is concluded that the concepts of clinal and ecotypic variation are not mutually exclusive. The natural distribution of Sitka spruce is illustrated and the literature on variation in individual characters is discussed. With the exception of wood qualities, anatomical and morphological traits have received little attention. Most research has been concentrated on variation in total growth and survival as determined from provenance tests. On the basis of its long and continuous range, and from a consideration of the literature, Sitka spruce might be expected to show gradual variation with respect to latitude. However, the number of characters studied and the intensity of sampling have been too low to allow a detailed analysis of the variation pattern. (Author's summary.)

263. ________
1965. Variation in seed characteristics of Sitka spruce. Advancing Frontiers Plant Sci. (New Delhi) 10: 11-24, illus.

Variations in seed characteristics were studied using bulk collections from 30 sources. Seed weight was not significantly related to latitude, but there was a tendency for northerly provenances to have heavier seed. Germination rate was improved by cold soaking, but germinative capacity was not affected by soaking, gibberellic acid, or alternating temperatures. Differences in embryo size and cotyledon numbers are discussed.

264. ________
1965. Karyotype analysis of Sitka spruce, *Picea sitchensis* (Bong.) Carr. Silvae Genet. 14(4): 127-132., illus.

No statistically significant differences were observed in the basic haploid karyotypes of 10 provenances, and the data were pooled to obtain the karyotype of the species. However, there was a significant increase in total haploid complement length and nuclear volume as latitude of seed origin increased. (From author's summary.)

265. ________
1966. Genetic variation in seedling development of Sitka spruce, *Picea sitchensis* (Bong.) Carr. Forestry 39(1): 68-94., illus.

Development of the terminal bud in 1-year seedlings is illustrated and described as a continuous process. The same sequence of morphological events occurred in 47 provenances examined, but timing was different. Flushing was controlled largely by temperature, and the time of flushing reflected temperature regime of the native habitat. The effect of provenance on height growth is discussed.

266. ________
1966. Provenance variation in growth of seedling apices of Sitka spruce. Forest Sci. 12(3): 170-175.

Describes shoot apex development for seedlings of *Picea sitchensis* (Bong.) Carr. from 47 provenances. The three stages previously used to describe this development in other conifers are applicable to this species, but times of initiation and duration of each stage vary among the provenances. Anatomical evidence confirmed morphological evidence for a pattern of development variation that was closely related to the natural distribution of the species. Elongation and needle production continued into July for seedlings from Alaska and into September for those from California. Bud scale production followed and extended for approximately 1 month. The rest stage extended until April, with only 2 weeks separating the first and last provenances in time of spring flushing. The size and shape of the shoot apex varied during these stages, but the zonation pattern could not be distinguished consistently. (Author's summary.)

267. _______
1966. Variation in colour of Sitka spruce seedlings. Quart. J. Forest. 60(1): 51-54.

Genetic variation was demonstrated among seedlings from 47 provenances of Sitka spruce in the rate of development of stem and needle coloration. The pattern of variation paralleled the natural distribution of the species, reflecting changes in environment through the range. Needle glaucousness was subject to local environmental modification. (Author's summary.)

268. Burns, Findley.
1911. The Olympic National Forest: its resources and their management. U.S. Dep. Agr. Forest Serv. Bull. 89, 20 pp., illus.

269. Buszewicz, G. M.
1967. Forest tree seed. Part I. *In* Report on forest research for the year ended March 1966. Great Brit. Forest. Comm., pp. 16-20. London: H. M. Stationery Office.

270. Buszewicz, G.
1967. Forest tree seed. *In* Report on forest research for the year ended March 1967. Great Brit. Forest. Comm., pp. 22-27. London: H. M. Stationery Office.

The Forest Tree Seed Section is responsible for seed procurement, extraction, processing, storage, testing, and distribution. Similar reports of the Section are available in earlier annual reports of the Forestry Commission.

271. _______ and Holmes, G. D.
1957. Seven years seed testing experience with tetrazolium viability test for conifer species. *In* Report on forest research for the year ended March 1957. Great Brit. Forest. Comm., pp. 142-151. London: H. M. Stationery Office.

Describes the history and technique of the tetrazolium bromide viability test. Results of 766 tests on 11 species, including Sitka spruce, are analyzed and compared with standard Copenhagen tank germinator tests. The tetrazolium results were nearest to the control when seeds having at least five-sixths of the total embryo surface stained were recorded as viable.

272. Buxton, E. W., Sinha, Indu, and Ward, Valerie.
1962. Soil-borne diseases of Sitka spruce seedlings in a forest nursery. Brit. Mycol. Soc. Trans. 45(4): 433-448.

Seedlings at Old Kennington nursery on plots treated annually with formalin for 5 years showed symptoms of damping off, browning of leaves and roots, and stunting. Plants on adjacent plots treated only once with formalin were normal. In an examination of the microflora of the rhizosphere and seedling roots, 13 fungus genera were identified. Microflora may be introduced into the nursery on contaminated seed. Tolerance to formalin may be developed.

273. Cadell, Henry M.
1910. On the growth of the Sitka spruce and other trees in Linlithgowshire and Stirlingshire. Roy. Scot. Arboricult. Soc. Trans. 23: 158-167.

274. Cadman, W. A.
1953. Shelterbelts for Welsh hill farms. Great Brit. Forest. Comm. Forest Rec. 22, 30 pp., illus.

Sitka spruce is a suitable species for shelterbelt planting on wet sites and peaty soils. It grows fast and produces good volumes and will withstand wind as well as other species tested.

275. ________
1955. Farm and forest: 2. Planting of shelterbelts. 3. Layout and choice of species for shelterbelts. Agriculture 62(2): 92-93, illus. 62(3): 142-143.

Discusses shelterbelts in general with special reference to Britain. Sitka spruce is recommended for exposed areas with wet, acid soils. Brief advice on planting and tending is given.

276. Cahalane, Victor H.
1959. A biological survey of Katmai National Monument. Smithsonian Misc. Collect. 138(5), Pub. 4376, 246 pp. plus 17 plates, 1 map.

Small groves or lone specimens of Sitka spruce grow at several locations in Kukak and Kuliak Bays. Trees on Takli Island in Amalik Bay, killed by the ash fall of 1912, were still standing in 1954.

277. Cameron, A. E.
1936. *Adelges cooleyi* Gillette (Hemiptera, Adelgidae) of the Douglas fir in Britain: Completion of its life cycle. Ann. Appl. Biol. 23: 585-605.

Reports on the first discovery in Britain of a viable generation I (sexuales) on Sitka spruce.

278. Campbell, George I.
1952. Some observations on the experience of an amateur with special reference to thinning in an area of rapid growth. Scot. Forest. 6(1): 3-9.

Advises severe early thinning, together with pruning, of Sitka spruce on the west coast of Scotland to take full advantage of the growth potential.

279. Campbell, W. G., and McDonald, I. R. C.
1952. The chemistry of the wood cell wall. Part I. The delignification of beech and spruce woods by sodium chlorite in buffered aqueous solution. J. Chem. Soc. 1952: 2644-2650.

Some 90 percent of acid lignin can be removed without significant loss of polysaccharide, but attempts to delignify the wood residues further cause appreciable loss.

280. Canada Forest Service.
1926. Sitka spruce. Can. Forest Serv. Tree Pam. 12, 6 pp., illus.

281. Canada Department of Forestry.
1951. Canadian woods: their properties and uses. Ed. 2, 367 pp., illus. Ottawa: Queen's Printer.

282. ________
1963. Native trees of Canada. Ed. 6, Can. Dep. Forest. Bull. 61, 291 pp., illus.

283. Capps, Stephen R.
1937. Kodiak and vicinity, Alaska. U.S. Dep. Int. Geol. Surv. Bull. 868-B, pp. 93-134, illus.

284. Carl, G. Clifford, Guiguet, C. J., and Hardy, George A.
1952. A natural history survey of the Manning Park area, British Columbia. Brit. Columbia Prov. Mus. Occas. Pap. 9, 130 pp., illus.

285. Carlisle, A., and White, E. J.
1962. Establishment of trees on Pennine moorland: species trials at Moor House. Great Brit. Natur. Conserv. Rep. 1961/62: 60-61.

Describes problems encountered in establishing trees. A few (200) Sitka spruce, including 100 of Alaskan provenance, were planted in the Nether Hearth enclosure.

286. Carmichael, Ralph L., and Dick, James.
1956. A seeding of Sitka spruce-western hemlock in southwestern Washington. Northwest Sci. 30(2): 56-60.

Describes experimental helicopter seeding of Sitka spruce and western hemlock on three accidental burns in southwestern Washington. The seeding was successful on each of the burns. Broadcast seeding of Sitka spruce and western hemlock is recommended as an effective method of artificial reforestation for recent burns in the Sitka spruce-western hemlock type of southwestern Washington.

287. Carrasco, Mario M.
1954. Primeros resultados de reforestacion con coniferas exoticas en las zonas Pre-Cordilleranas de la Provincia de Valdivia. [Preliminary results of afforestation with exotic conifers in the Andean foothills of Valdivia Province.] Bosques y Maderas (special issue of Chile Maderero) 1954: 12-14. [In Spanish.]

An attempt to establish Sitka spruce proved unsuccessful.

288. Carriere, Elie-Abel.
1855. Traite general des Coniferes. [General dissertation on the conifers with descriptions of all species and varieties.] 656 pp. Paris: Chez L'Auteur. [In French.]

289. Carstensen, John P.
1961. Gluing characteristics of softwood veneers and secondary western hardwoods. Forest Prod. J. 11: 313-315.

290. Cartwright, K. St. G.
1930. A decay of Sitka spruce timber, caused by *Trametes serialis*, Fr. A cultural study of the fungus. Great Brit. Dep. Sci. & Ind. Res. Forest Prod. Res. Bull. 4, 26 pp. plus 6 plates.

291. _______ and Findlay, W. P. K.
1931. The effect of progressive decay by *Trametes serialis*, Fr. on the mechanical strength of the wood of Sitka spruce. Great Brit. Dep. Sci. & Ind. Res. Forest Prod. Res. Bull. 11, 18 pp. plus 9 figs.

292. Cary, N. LeRoy.
1922. Sitka spruce: its uses, growth, and management. U.S. Dep. Agr. Bull. 1060, 38 pp., illus.

A comprehensive discussion of the silvics, management, production, and uses of Sitka spruce.

293. _______
1922. Sitka spruce: its uses, growth, and management. Timberman 23(9): 140-144.

294. Cash, Edith K.
1958. Some new Discomycetes from California. Mycologia 50: 642-656, illus.

295. Cech, M., Kralik, O., and Blattny, C.
1961. Rod-shaped particles associated with virosis of spruce. Phytopathology 51(3): 183-185.

Rod-shaped particles have been found in exudates from twigs of Sitka spruce. Infected trees have shortened chloratic needles, and defoliation is frequently severe. The virus is probably identical with that described from Norway spruce in Czechoslovakia where it is transmitted by *Adelges abietis*.

296. Cecil, George H.
1913. Alaska lumber industry gives evidence of attaining considerable size. Timberman 14(11): 46.

297. _______
1920. Alaska pulpwood resources to be developed. Timberman 21(8): 36-38.

298. Chalk, L.
1930. Tracheid length with special reference to Sitka spruce. Forestry 4: 7-14.

299. _______ and Bigg, J. M.
1956. The distribution of moisture in the living stem in Sitka spruce and Douglas-fir. Forestry 29(1): 5-21.

Summer moisture content in Sitka spruce was highest on the site with the highest rainfall and lowest on the site with the lowest rainfall. Moisture content decreased suddenly in late summer. There was a sharp moisture gradient from cambium to heartwood, the saturated zone being very narrow except on the wet Sitka spruce site.

300. Chard, J. S. R.
1964. The Roe deer. Great Brit. Forest. Comm. Leafl. 45, 26 pp., illus.

In a 12-year-old plantation, Sitka spruce showed no significant browse damage, because of its prickly foliage. In contrast, Norway spruce was severely hedged.

301. Charles, W. N.
1956. The effects of a vole plague in the Carron Valley, Stirlingshire. Scot. Forest. 10(4): 201-204.

Describes effects of voles on ground vegetation and attack in young trees. *Picea abies, P. sitchensis,* and *Pinus sylvestris* were heavily attacked; *P. sitchensis* alone resprouted from below the damaged area.

302. Charlon, J. C.
1958. Die Düngewirkung von Thomasphosphat bei Waldbäumen. [The fertilizing effect of basic slag on forest trees.] Phosphorsäur 18: 220-224. [In German.]

303. _______
1961. Essais de fertilisation sur arbes forestiers. [Fertilizer trials on forest trees.] C. R. Acad. Agr. (France) 47(6): 288-292. [In French.]

Presents summarized results of fertilizer trials with basic slag on Sitka spruce and other conifers on various sites in western France, 1954-60. Basic slag (400 grams per plant) and nitrate fertilizer (100 grams and 200 grams per plant) were used. Marked increases in early growth were noted in comparison with untreated controls.

304. Chaytor, A. H.
1920. Planting Douglas-fir and Sitka spruce in cleared coppice. Quart. J. Forest. 14: 161-164.

305. Chen, Hsien-Fang.
1955. Growth and mineral uptake of Sitka spruce (*Picea sitchensis*) in solution cultures. 69 pp., illus. (M.S. thesis on file at Univ. Wash.)

Sitka spruce seedlings grown in mineral solutions in the greenhouse were weak and stunted in both low N and low P treatments; serious necrosis and reduced growth were seen in the low Mg solution; development was somewhat retarded in low K, low Ca, and minus B treatments; and no major effect was noted between low S and minus Fe treatments and the control. Nutrient levels found in deficient foliage are given.

306. Chen, Peter Yuen San, and Bossfeld, Ralph.
1964. Effect of viscosity on permeability of Sitka spruce to aqueous glycerin. Tappi 47: 750-752.

307. Childs, T. W., and Clark, J. W.
1953. Decay of windthrown timber in western Washington. U.S. Bur. Plant Ind. Forest Pathol. Spec. Release 40, 20 pp.

Measurements in windthrown Douglas-fir, Sitka spruce, western hemlock, and Pacific silver fir indicate that hemlock and silver fir decay rapidly in all local conditions in this region, that Sitka spruce decays fairly rapidly, and that Douglas-fir heartwood is quite durable though its sapwood decays fairly rapidly. Temperature is probably the principal factor, other than diameter, determining the rate of decay in fallen trees. In all species, decay is usually negligible in the first year after windthrow but is well started in the sapwood by the end of the second year.

308. Chopinet, R.
1962. Les Tsuga et leurs hybrides. III. Especes d'origine hybride. [The hemlocks and their hybrids. III. Species of hybrid origin.] Rev. Hort. 134(2.247): 266-268. [In French.]

Describes two purported intergeneric crosses between *Picea sitchensis* and *Tsuga heterophylla*.

309. Christie, J. M.
1958. Alignment charts and form height tables for determining stand volumes of conifers, oak, and beech. Great Brit. Forest. Comm. Forest. Rec. 37, 18 pp.

Includes tables of form height, and alignment charts, for Scots pine, Corsican pine, European larch, Japanese larch, Norway spruce, Sitka spruce, Douglas-fir, western hemlock, grand fir, oak, and beech.

310. Chrystal, R. N.
1916. The forest-insect problem in Stanley Park. Brit. Columbia Entomol. Soc. Proc. 9: 63-64.

Describes effects of *Chermes cooleyi, Aphis abietina,* and *Dendroctonus obesus* on Sitka spruce in Stanley Park at Vancouver, British Columbia.

311. Clapham, A. R., Tutin, T. G., and Warburg, E. F.
1952. Flora of the British Isles. 1591 pp. Cambridge: Cambridge Univ. Press.

312. Clapp, Earle H., and Boyce, Charles W.
1924. How the United States can meet its present and future pulpwood requirements. U.S. Dep. Agr. Bull. 1241, 100 pp., illus.

Includes a description of the role of Sitka spruce.

313. Clark, Brian John.
1965. Variation in cone and seed characteristics of Sitka spruce in British Columbia. 78 pp., illus. (B.S. in Forestry thesis, on file at Univ. Brit. Columbia.)

314. Clifford, N.
1957. Timber identification for the builder and architect. 141 pp., illus. London: Leonard Hill, Ltd.

Describes briefly the color, characteristics, durability, and suitable uses of Sitka spruce wood.

315. Cole, Bert L., and Webster, L. T.
1962. Timber harvest report. Wash. Dep. Natur. Resources, 40 pp.

316. Coleman, Babette Brown, Muencher, Walter C., and Charles, Donald R.
1956. A distributional study of the epiphytic plants of the Olympic Peninsula, Washington. Amer. Midland Natur. 56(1): 54-87.

Sitka spruce was second only to red alder in relative receptivity to epiphytes. Epiphytes found on Sitka spruce are listed.

317. Colhoun, J., McElroy, G., and Ward, P. J.
1961. Wastage of apples in relation to the wood used for storage boxes. Plant Pathol. 10(3): 116-118.

Apples stored in boxes made of Sitka spruce showed no damage.

318. Colley, Reginald H.
1921. The effect of incipient decay on the mechanical properties of airplane timber. Phytopathology 11: 45.

319. Collingwood, G. H., and Brush, Warren D.
1964. Knowing your trees. (Rev. and ed. by Devereux Butcher.) 349 pp., illus. Wash., D. C.: Amer. Forest. Ass.

320. Colquhoun, M. K.
1951. The wood pigeon in Britain. Great Brit. Agr. Res. Counc. Rep. 10, 69 pp.

Wood pigeons sometimes damage young conifers by perching on the leading shoot, which results in its being bent at right angles or broken, so that the tree forks and the general shape is spoiled. Sitka spruce suffers most.

321. Condrashoff, S. F.
1964. Sitka spruce terminal damage. Can. Dep. Forest. Forest Entomol. Pathol. Br. Annu. Rep. 1964: 132-133.

Damage to terminal buds of Sitka spruce on the Queen Charlotte Islands is caused primarily by *Epinotia* n. sp. *Zeiraphera* nr. *ratzeburgiana* and a gall midge, *Rhabdophaga* sp. nr. *Swainei*. An eriophyid mite, *Trisetacus grosmanni* (Keifer), is involved mainly in damage to lateral buds. Life histories of these insects are mentioned briefly.

322. ________
1966. Larval descriptions of *Zeiraphera pacifica* Freeman and *Epinotia hopkinsana* (Kearfott) (Lepidoptera: Olethreutidae). Can. Entomol. 98: 703-706, illus.

Full-grown larvae of *Zeiraphera pacifica* Freeman and *Epinotia hopkinsana* (Kearfott) are described and illustrated. Both insects have attracted attention in recent years by their damage to stands of young Sitka spruce on the Queen Charlotte Islands. The larvae destroy the terminal buds, altering form and height growth of the trees. The potential economic significance of these pests has necessitated annual population surveys and biological studies, the effectiveness of which depends in part on identification of the larvae. (From author's summary.)

323. Conn, H.
1958. Stem analysis of trees at Baronscourt. Forest. Northern Ireland 1(4): 25-30.

324. Cooke, Wm. Bridge.
1955. Some fungi from Alaska. Northwest Sci. 29(4): 127-138.

Lists the following fungi occurring on living or dead Sitka spruce as species new to Alaska: *Hypoxylon coccineum, Corticium hiemalis, Corticium microsporum, Peniophora glebulosa,* and *Phlebiella vaga.* Other species not new to Alaska are also reported.

325. _______ and Lawrence, Donald B.
1959. Soil mould fungi isolated from recently glaciated soils in southeastern Alaska. J. Ecol. 47: 529-549, illus.

326. Cooper, W. S.
1923. The recent ecological history of Glacier Bay, Alaska. II. The present vegetation cycle. Ecology 4(3): 223-246, illus.

327. Cooper, William S.
1930. The seed plants and ferns of the Glacier Bay National Monument, Alaska. Torrey Bot. Club Bull. 57: 327-338.

328. _______
1931. A third expedition to Glacier Bay, Alaska. Ecology 12(1): 61-95, illus.

329. _______
1931. The layering habit in Sitka spruce and the two western hemlocks. Bot. Gaz. 91: 441-451, illus.

Western hemlock and mountain hemlock were found to layer, although not so commonly or vigorously as Sitka spruce.

330. _______
1937. The problem of Glacier Bay, Alaska: a study of glacier variations. Geogr. Rev. 27(1): 37-62, illus., plus map.

331. _______
1939. Additions to the flora of the Glacier Bay National Monument, 1935/36. Torrey Bot. Club Bull. 66: 435-436.

332. _______
1939. A fourth expedition to Glacier Bay, Alaska. Ecology 20(2): 130-155, illus.

333. ________
1942. Vegetation of the Prince William Sound region, Alaska; with a brief excursion into post-Pleistocene climatic history. Ecol. Monogr. 12: 1-22, illus.

334. ________
1957. Vegetation of the Northwest-American Province. Pacific Sci. Congr. Proc. 8(4): 133-138.

Sitka spruce is listed as one of the 12 character trees of the province.

335. Cooper, William Skinner.
1923. The recent ecological history of Glacier Bay, Alaska. I. The interglacial forest of Glacier Bay. Ecology 4(2): 93-128, illus., plus map.

336. ________
1924. The forests of Glacier Bay--present, past, and yet unborn. J. Forest. 22: 16-23, illus.

337. Corliss, J. F., and Dyrness, C. T.
1965. A detailed soil-vegetation survey of the Alsea area in the Oregon Coast Range. *In* Forest-soils relationships in North America, Chester T. Youngberg (ed.). Second North Amer. Forest Soils Conf. Proc. 1963: 457-483, illus.

338. Cornwall, Geo. M.
1926. Christening Pacific coast woods. Timberman 28(1): 87, 90, 92.

339. Cote, W. A., Jr.
1965. Cellular ultrastructure of woody plants. Advanced Sci. Seminar Proc. 1964. 603 pp., illus. Syracuse, New York: Syracuse Univ. Press.

340. Coville, Frederick Vernon, and Funston, Frederick.
1895. Botany of Yakutat Bay, Alaska, with a field report. U.S. Nat. Herb. Contr. 3(6): 325-353.

341. Cowan, Ian McTaggart.
1945. The ecological relationships of the food of the Columbian black-tailed deer, *Odocoileus hemionus columbianus* (Richardson), in the coast forest region of southern Vancouver Island, British Columbia. Ecol. Monogr. 15(2): 109-139.

Sitka spruce is listed as slightly palatable. New growth is eaten early in spring, casually or under stress.

342. Cowan, William C.
1962. Shear stress in two wood beams over wood block supports. USDA Forest Prod. Lab. Rep. 2249, 52 pp., illus.

Presents and analyzes the results of two experiments to determine the horizontal shear-stress distribution in wood beams (straight-grained, clear Sitka spruce specimens) over points of support.

343. Cowdrey, D. R., and Preston, R. D.
1966. Elasticity and microfibrillar angle in the wood of Sitka spruce. Roy. Soc. Proc. (London) 166B(1004): 245-272.

344. Cowling, Ellis B.
1962. Influence of transient capillaries on the enzymatic degradation of plant cell walls. Phytopathology 52(1): 6.

345. _______ and Sachs, Irving B.
1960. Detection of brown rot with osmium tetroxide stain. Forest Prod. J. 10: 594-596.

A 1-percent (weight per volume) aqueous solution of OsO_4 produced a dark stain in less than 5 minutes on specimens of southern pine, Sitka spruce, and sweetgum infected with brown-rot fungi, but took more than 20 minutes to stain sound wood or wood infected with white rot.

346. Cox, William T.
1911. Reforestation on the National Forests. Part I.--Collection of seed. Part II.--Direct seeding. U.S. Dep. Agr. Forest Serv. Bull. 98, 57 pp., illus.

347. Crampton, C. B.
1966. Soils, forests, and pastures in South Wales. Forestry 39(2): 171-188.

348. Crocker, Robert L., and Dickson, B. A.
1957. Soil development of the recessional moraines of the Herbert and Mendenhall Glaciers, south-eastern Alaska. J. Ecol. 45: 169-185, illus.

349. _______ and Major, Jack.
1955. Soil development in relation to vegetation and surface age at Glacier Bay, Alaska. J. Ecol. 43(2): 427-448.

Describes the main steps in vegetation development from initial colonization of the bare surfaces to establishment of a forest dominated by Sitka spruce.

350. Crooke, Myles.
1960. *Adelges cooleyi*, an insect pest of Douglas-fir and Sitka spruce. Great Brit. Forest Comm. Leafl. 2, 8 pp., illus.

351. _______
1962. The United Kingdom's position in relation to the changed status of the giant spruce bark beetle, *Dendroctonus micans* Kug., in Europe. Eighth Brit. Commonwealth Forest. Conf., East Africa, 1962. Great Brit. Forest. Comm. 7 pp.

Indicates the danger to British forestry of the possible importation of *D. micans*, which, on the continent of Europe, severely damages Sitka spruce stands. The import restriction order designed to reduce the risk is described. (From author's summary.)

352. Crosby, David.
1965. Conditions of forest insects in forest regions, Alaska. *In* Forest insect conditons in the United States, 1964, p. 37. Forest Serv. U.S. Dep. Agr.

353. _______
1966. Conditions of forest insects in forest regions, Alaska. *In* Forest insect conditions in the United States, 1965, p. 43. Forest Serv. U.S. Dep. Agr.

354. _______
1967. Forest conditions in the various regions, Alaska. *In* Forest insect conditions in the United States, 1966, pp. 7-9, illus. Forest Serv. U.S. Dep. Agr.

355. _______ and Baker, Bruce H.
1966. Forest insect and disease conditions in Alaska during 1966. USDA Forest Serv., Alaska Reg. 10, Div. Timber Manage., 11 pp., illus.

356. Crowther, E. M.
1950. Committee on nutrition problems in forest nurseries: summary report on 1948 experiments. *In* Report on forest research for the year ended March 1949. Great Brit. Forest. Comm., pp. 60-64. London: H. M. Stationery Office.

Transplant manuring experiments with Sitka spruce in a very acid moorland soil and on a calcareous agricultural soil showed large responses in height to superphosphate applied before lining out and to ammonium sulphate given as a top dressing in April. The only failure was on an unusually acid sandy soil (pH 4.0) where a top dressing with ammonium sulphate checked height growth. Other soluble N fertilizers gave good results.

357. _______
1951. Nutrition problems in forest nurseries. *In* Report for 1950, pp. 40-41. Rothamsted [England] Exp. Sta.

Sitka spruce seedlings showed large responses to each of the major nutrients on very acid soils. In neutral or slightly acid soils of old nurseries, Sitka spruce generally made poor growth even when well manured with compost or fertilizers.

358. _______
1951. Sub-committee on nutrition problems in forest nurseries: summary report on 1949 experiments. *In* Report on forest research for the year ended March 1950. Great Brit. Forest. Comm., pp. 97-105. London: H. M. Stationery Office.

A positive response of Sitka spruce to phosphate was observed. Nitrogen depressed growth during a drought year.

359. _______, Warren, R. G., and Benzian, B.
1951. Nutrition problems in forest nurseries. Rothamsted [England] Exp. Sta. Rep. 1950: 40-41.

Sitka spruce seedlings showed large responses to each of the major nutrients in experiments on very acid soils, but in some of these experiments composts well supplied with N, P, and K gave better results than inorganic fertilizers. It appeared that fertilizer N applied in the seedbeds in spring and in an early summer top-dressing had been leached out of the surface soil during the very wet summer and autumn before the period of most active growth. In the neutral or slightly acid soils of old nurseries, Sitka spruce seedlings generally make very poor growth, even when well manured with compost or fertilizers. In 1950, at several nurseries, there were striking responses on such soils to acidification in previous years by $(NH_4)_2SO_4$ or S. Repeated dressings of $(NH_4)_2SO_4$ appear to provide a safe method of supplying available N and at the same time acidifying the soil. Soil sterilization to prevent damping off is also discussed.

360. Crozier, John D.
1910. The Sitka spruce as a tree for hill planting and general afforestation. Roy. Scot. Arboricult. Soc. Trans. 23: 7-16 plus 1 plate.

361. Cunliffe, N.
1921. Defoliation of spruce by aphis (*Myzaphis abietina* Walker). Quart. J. Forest. 15: 213-214.

362. _______ and Ryle, G. B.
1923. The conifer spinning mite on Sitka spruce. [*Oligonychus* (*Paratetrauchus*) *ununguis*, Jacobi.] Quart. J. Forest. 17: 359-362.

363. Currier, Raymond A.
1963. Compressibility and bond quality of western softwood veneers. Forest Prod. J. 13: 71-80.

364. Curry, W. T.
1952. The effect of moisture content on the tensile strength of Sitka spruce. Aircraft Eng. 24(279): 142-143.

Test showed that on the average, a change in moisture content within the range 9 to 20 percent had no significant effect on tensile strength, but an increase to saturation significantly reduced it. The tensile strength for wood below 20-percent moisture content averaged 18,730 pounds per square inch, and at saturation, 14,750 pounds per square inch. The effect of moisture on strength varied with density.

365. _______
1961. Working stresses for structural laminated timber. Great Brit. Forest Prod. Res. Board Spec. Rep. 15, 50 pp., illus.

Reports and tabulates basic stresses for laminated timber of imported woods, including Sitka spruce, for dry and damp exposures.

366. Curtis, Carlton C., and Bausor, S. C.
1943. The complete guide to North American trees. 337 pp., illus. New York: New Home Library.

367. Dachnowski-Stokes, A. P.
1941. Peat resources in Alaska. USDA Bur. Plant Ind. Div. Soil Surv. Tech. Bull. 769, 84 pp., illus.

368. Dallas, W. G.
1962. The progress of peat afforestation in northern Ireland. Irish Forest. 19(1): 84-93.

Since 1955, Sitka spruce has been the principal species used for peatland afforestation in northern Ireland.

369. Dallimore, W.
1907. Visit to Newport and South Wales. Kew Bull., pp. 388-396.

Details of 70-year-old specimen trees 90 to 100 feet tall at Singleton Abbey are noted on page 393.

370. _______
1912. Notes on Durris Estate. Kew Bull., pp. 325-326.

371. _______
1912. VI.--Notes on trees suitable for experimental forestry, III. American conifers. Roy. Bot Gard., Kew, Misc. Inform. Bull. 2: 75-85.

372. _______
1948. A very fine specimen of Sitka spruce (*Picea sitchensis*). Quart. J. Forest. 42: 162-163.

373. _______
1955. The National Pinetum. *In* Guide to National Pinetum and forest plots at Bedgebury. Ed. 2. Great Brit. Forest. Comm., pp. 6-22.

374. _______ and Jackson, A. Bruce.
1923. A handbook of Coniferae including Ginkgoaceae. Ed. 1, 570 pp., illus. New York: Longmans, Green & Co., London: Edward Arnold & Co. (Ed. 4, 1966, rev. by S. G. Harrison, 729 pp., illus.)

375. Darker, G. D.
1932. The Hypodermataceae of conifers. Arnold Arboretum Contrib. 1, 131 pp.

376. Darlington, C. D., and Wylie, A. P.
1955. Chromosome atlas of flowering plants. Ed. 2, 519 pp., illus. London: George Allen & Unwin, Ltd.

Sitka spruce chromosome number is 24.

377. Daubenmire, Rexford F.
1953. Notes on vegetation of forested regions of the far northern Rockies and Alaska. Northwest Sci. 27(4): 125-138.

378. Davidson, Eric Duncan.
1967. Synecological features of a natural headland prairie on the Oregon coast. 79 pp., illus. (M.S. thesis on file at Oreg. State Univ., Corvallis.)

Describes ecotone between natural prairie and Sitka spruce-western hemlock forest.

379. Davidson, J. C. N.
1959. Silvical characteristics. *In* Forest handbook for British Columbia. Ed. 2, pp. 557-571. Vancouver: Forest Club, Univ. Brit. Columbia.

Describes silvical characteristics of Sitka spruce, including information on soil requirements.

380. Davidson, John, and Abercrombie, I.
1927. Conifers, junipers, and yew: gymnosperms of British Columbia. 72 pp., illus. London: T. Fisher Unwin.

381. Davidson, Ross W., and Lombard, Frances.
1954. Brick red stain of Sitka spruce and other wood substrata. Phytopathology 44: 606-607.

382. Davies, E. J. M.
1966. Dappled shade work with Sitka spruce. Scot. Forest. 20(1): 52-55.

Describes planting Sitka spruce beneath scrub birch. By careful planting, a conifer crop can be established cheaply and safely without heavy clearing.

383. ________
1967. Aerial fertilization at Kilmory Forest. Scot. Forest. 21(2): 99-104, illus.

Applications of ground mineral phosphate on small plots of slow-growing Sitka spruce in the West Scotland Conservancy resulted in a tripling of leader growth and led to recent large-scale applications at Kilmory Forest. Regular aerial applications of fertilizer are foreseen as a standard silvicultural practice. Fertilization can also extend the range of highly productive species such as Sitka spruce to infertile sites currently managed for lodgepole pine.

384. ________
1967. Silviculture of the spruces in West Scotland. Forestry 40(1): 37-46.

An account of the silviculture of Norway and Sitka spruce practiced in the West (Scotland) Conservancy of the Forestry Commission in the past 50 years. Present methods are summarized and future developments forecast. A more intensive form of silviculture is advocated for Sitka spruce. (Author's summary.)

385. Day, R. J.
1967. A plea for standard tree name abbreviations. Forest. Chron. 43: 121-134.

The author proposes a system for abbreviating tree names in the vernacular. Simple rules are set forth and a list of abbreviations presented. The following is proposed for *Picea sitchensis:* abbreviation--PI's, English vernacular--Sitka spruce, French vernacular--Epinette de Sitka.

386. Day, W. R.
1928. Damage by late frost on Douglas-fir, Sitka spruce, and other conifers. Forestry 2: 19-30.

387. _______
1947. On the effect of changes in elevation, aspect, slope, and depth of freerooting material on the growth of European larch, Japanese larch, Sitka spruce, and Scots pine in Mynydd Duu Forest. Forestry 20: 7-20, illus.

388. _______
1949. The soil conditions which determine wind-throw in forests. Forestry 23: 90-95.

The effect of soil conditions on root development and anchorage against windthrow in Britain is examined briefly. Particular soil and vegetation types are mentioned, with special reference to spruce.

389. _______
1950. Root disease and butt-rot of conifers. Imp. Forest. Inst. Rep. (Oxford) 1948/49: 11-12.

390. _______
1950. The drought-crack of conifers. Imp. Forest. Inst. Rep. (Oxford) 1948/49: 12-13.

Cracking occurred over a wide area in Wales and parts of Scotland. An examination of the anatomy of the affected trees showed that drought was the probable cause. Sitka and Norway spruces have been the most seriously affected by drought-crack, but all the conifers commonly grown, except the pines, have been affected. The same phenomenon has also been reported from Denmark.

391. _______
1950. The fungus flora of spruce stems. Imp. Forest. Inst. Rep. (Oxford) 1948/49: 14.

Borings taken in the main stems of living and outwardly uninjured Sitka spruce showed that they were colonized by various species of fungi. Borings taken in Sitka spruce of the same size elsewhere did not show any fungus flora. This colonization seems to have been made possible by debility caused by disease. The discovery that spruce may bear a fungus flora in their wood, even when they appear to be healthy as judged by the appearance of the crown, is a matter of considerable importance in view of the extensive use of spruces in afforestation in Great Britain.

392. _______
1950. Forest hygiene. II. The imperfection of the environment and its importance in the management of forests. Empire Forest. Rev. 29(4): 307-315.

Discusses the environmental factors in the development of disease, illustrated by data on the influence of soil profiles on the growth of Sitka spruce.

393. _______
1951. Root disease of conifers with special reference to the dying of Sitka spruce and its liability to wind-throw. Imp. Forest. Inst. Rep. (Oxford) 1949/50: 12-13.

394. ________ 1951. The fungus flora of live spruce stems. Imp. Forest. Inst. Rep. (Oxford) 1949/50: 13-14.

Isolation made from drought-cracked trees shows that their wood is always colonized by fungi, some of which are hymenomycetes known to cause decay of timber. Most have proved to be either ascomycetes or *fungi imperfecti*. Heartwood of trees that had not suffered from drought-crack or other known injury, but which grew among drought-cracked trees, also contained fungi, though to a lesser extent.

395. ________ 1952. Root disease of conifers in relation to soil conditions. (a). Development of butt-rot in conifers in relation to soil depth. (b). The dying of Sitka spruce. Imp. Forest. Inst. Rep. (Oxford) 1950/51: 13-14.

396. ________ 1953. The fungus flora of the main stem of standing trees. Imp. Forest. Inst. Rep. (Oxford) 1951/52: 15.

Samples of Sitka spruce from Aberdeenshire that had suffered from drought-crack in 1947 showed general infection of the heartwood by *Fomes annosus*. In order to determine whether *F. annosus* was present over any wider area, standing trees were sampled in Pitfichie Forest. Both cracked and uncracked trees were sampled, and all the cracked and most of the uncracked trees had heartwood infected with mycelia. These have not been identified, but *F. annosus* was not present and it is unlikely that most of the mycelia are active in wood destruction.

397. ________ 1953. The growth of Sitka spruce on shallow soils in relation to root disease and wind-throw. Forestry 26(2): 81-95.

398. ________ 1954. Cambial injuries on the main stem of conifers. Imp. Forest. Inst. Rep. (Oxford) 1952/53: 13-14.

399. ________ 1954. Drought crack of conifers. Great Brit. Forest Res. Forest. Comm. Rep. 26, 40 pp., illus.

Norway and Sitka spruce were affected by drought-crack following the exceptional drought of 1947. Drought-crack was shown to be correlated with shallow rooting depth in otherwise good soils. A secondary cause of the injury may be the light, poor structure of the wood and the occurrence of heart rot. A number of fungi associated with the condition are listed.

400. ________ 1955. The place of a species in the forest, with special reference to western North American species of conifer used in Britain. Forestry 28(1): 33-47.

Differences between climates of Queen Charlotte Islands and of England and Wales are discussed briefly. The site tolerance of the principal species within their own natural range is examined, with particular reference to Sitka spruce. Observing the climatic and edaphic position of species in their natural range suggests their place in Britain.

401. ________ 1957. Sitka spruce in British Columbia: a study in forest relationships. Great Brit. Forest. Comm. Bull. 28, 110 pp. plus 57 plates.

Results of a study, based on fieldwork in two regions of the coastal forest in British Columbia (Graham Island, and Terrace in the Skeena River drainage). Discusses the relationship between soil conditions and growth of Sitka spruce, specifically with respect to rooting depth, root and crown development, vigor, and stand conditions.

402. ________ 1958. Forest pathology: studies in 30- to 35-year-old, even-aged spruce stands with reference to the development of fluting, bark necrosis, and variations in crown density. Imp. Forest. Inst. Rep. (Oxford) 1957/58: 13-15.

403. ________ 1959. The influence of pathogenic factors in the rooting space on the development of even-aged plantations. Advance. Sci. 16(63): 212-236. (Also in 1960 Quart. J. Forest. 54(1): 33-53 and 1960 Empire Forest. Rev. 39(1): 38-53.)

Discusses, with some examples from Norway and Sitka spruce in Britain, the variations in survival and growth rate that occur with varying site-water relationships and soil types and depths. Gives illustrations from Britain, Denmark, Holland, and Germany of soil conditions in which disease (root infection with or without insect attack) of Sitka spruce has occurred as a result of deficiencies in the rooting space.

404. ________ 1960. Bark necrosis of Sitka spruce, Douglas-fir, and Norway spruce. Imp. Forest. Inst. Rep. (Oxford) 1959/60: 15-16.

405. ________ 1962. Notes on the development of the root system with Sitka spruce. Scot. Forest. 16(2): 72-83, illus.

A short discussion, based mainly on field observation, of the factors that appear to be important in the development of long, ropelike roots on Sitka spruce. It is suggested that the physical character of the soil is usually of basic importance, but that chemical and biotic factors often also play a part. (From author's summary.)

406. ________ 1963. The development of Sitka spruce on shallow peat. Scot. Forest. 17(4): 219-236.

407. ________ 1964. The development of flutes or hollows on main stems of trees and its relation to bark splitting and strip necrosis. Forestry 37(2): 145-160.

Field observations of Sitka spruce in Britain showed that flutes and strip necrosis often develop above the junction of two main roots or above a dead root, whereas ridges commonly are associated with actively functioning roots. Flutes, strip necrosis, and stem splitting are attributed to a submarginal supply of water that becomes most critical in the affected areas.

408. _______
1966. Biological aspects of thinning in conifer plantations. Forestry 39(2): 191-212.

Discusses thinning generally, with particular regard to effects of soil variability. Data on Sitka spruce plantations are used as examples.

409. _______ and Peace, J. R.
1946. Spring frosts. Ed. 2. Great Brit. Forest. Comm. Bull. 18, 111 pp., illus.

Sitka spruce was the species of economic importance most extensively damaged by the severe frosts of late April 1945 in Great Britain.

410. Dayton, William A.
1952. United States tree books; a bibliography of tree identification. U.S. Dep. Agr. Bibliogr. Bull. 20, 32 pp.

411. DeBrit, G.
1967. Disease of older stages. Dep. Lands, Ireland, Forest. Div. Forest Res. Rev. 1957/64: 37-40.

Examination of 36 trees marked for cutting in a 56-year-old Sitka spruce plantation revealed 18 trees infected with *Fomes annosus*. Volume loss in infected trees averaged 13.6 percent.

412. Decker, Henry F.
1966. Plants. *In* Soil development and ecological succession in a deglaciated area of Muir Inlet, southeast Alaska. Inst. Polar Studies Rep. 20, Part 4, pp. 73-96, illus.

Discusses the successional status of Sitka spruce and other plants on recently deglaciated land.

413. Decourt, N.
1964. Remarques sur la relation entre les circonférences à hauteur d'homme et les circonférences à hauteur de souche dans les peuplements forestiers. [The relation between g.b.h. and butt girth in forest stands.] Rev. Forest. Franc. 16(3): 216-224. [In French.]

Gives equations for obtaining girth at breast height from butt girth for several conifer species including Sitka spruce.

414. Defenbaugh, James E.
1906. History of the lumber industry of America. Vol. 1, 559 pp. Chicago: The American Lumberman.

415. Deffenbacher, Forrest W., and Wright, Ernest.
1954. Refrigerated storage of conifer seedlings in the Pacific Northwest. J. Forest. 52: 936-938.

Nursery and field comparisons of freshly dug plants showed that survival in Douglas-fir, noble fir, ponderosa pine, and Sitka spruce is not impaired by storage up to 6 months if humidity is held at 90-95 percent and temperature at 33° to 35°F., and if the air is adequately circulated. The roots should be packed in moist, washed shingle-tow (from western redcedar) or in moss, and wrapped in waterproof bundles with tops exposed. Mycorrhizae are apparently unaffected.

416. Delevoy, M. G.
1907. Naturalisation des essences exotiques. L'Epicea de Sitka. Ann. Gembloux 17(7): 378-400, illus. [In French.]

417. Department of Lands and Forests, British Columbia.
1957. Continuous forest inventory of British Columbia. Victoria. Brit. Columbia Forest Serv., 223 pp., illus., plus map and tables.

Gives a comprehensive inventory of the forests of British Columbia including the coastal Sitka spruce zone.

418. DeSilva, J. A. M.
1961. Moisture relations of Sitka spruce (*Picea sitchensis* Carr.) seedlings under conditions of varying soil moisture supply. J. Oxford Univ. Forest. Soc. 5(9): 21-26, illus.

Experiments on 1-year seedlings of Sitka spruce, sampled direct from the seedbed and grown in containers in which the soil was allowed to dry out, have shown that as the soil moisture fell below field capacity the water deficit in the needles increased and transpiration decreased. (From author's summary.)

419. Dick, James.
1954. The effect of tetramine rodent repellent coating of certain lots of Sitka spruce and western hemlock seed. Weyerhaeuser Forest. Res. Note 24, 2 pp., illus.

420. Dickson, D. A.
1966. The effect of nitrogenous and phosphatic fertilisers on the growth of checked trees on deep peat. Northern Ireland. Min. Agr. Res. Rec. 1965, 14(2): 61-71, illus.

Presents results of an investigation into the mineral nutrition of Sitka spruce and Contorta pine planted 24 years before, on deep ombrogenous peat. Analysis was made of nutrient content in foliage and in peat. It is concluded that, under the conditions investigated, the single application of large quantities of soluble mineral fertilizers to checked plantations is not an efficient practice.

421. ________
1966. The effect of nitrogenous and phosphatic fertilisers on the growth of checked trees on deep peat. Forest. N. Ireland 7(3): 18-32, illus.

422. Dickson, J. A., and Innes, R. A.
1959. Forestry in North Scotland. Forestry 32(1): 65-109.

Discusses forestry in North Scotland, including the role of Sitka spruce.

423. Dietrichson, Jon.
1961. Bruker vi mellomeuropeiske provenienser riktig? [Are central European provenances being used correctly in Norway?] Norsk Skogbruk 7(2): 67-70, illus. [In Norwegian.]

Discusses the resistance of various provenances to autumn frosts and summarizes briefly studies on the date of completion of growth of pine, spruce, Douglas-fir, Sitka spruce, and western hemlock.

424. Dinwoodie, J. M.
1962. Some ring-width patterns in Sitka spruce timber from North America. Forestry 35(1): 22-26.

Variations in ring-width pattern of Sitka spruce through most of its life in its natural habitat are demonstrated from photographs of 10 cross sections. It is suggested that, besides being subject to the annual fluctuations in growth due to climatic variation, the tree in the natural forest is subject to periodic suppression and release, and that it has considerable powers of recovery. In plantations, therefore, Sitka spruce should respond to thinnings made even late in the rotation. (From author's summary.)

425. _______
1963. Variation in tracheid length in *Picea sitchensis* (Carr.). Great Brit. Dep. Sci. & Ind. Res. Forest Prod. Res. Spec. Rep. 16, 55 pp., illus.

Presents the results of an investigation into the variation in tracheid length in Sitka spruce within the annual ring, within the tree, and between trees of different provenances.

426. _______ and Richardson, S. D.
1961. Studies on the physiology of xylem development. Part II: some effects of light intensity, day length and provenance on wood density and tracheid length in *Picea sitchensis*. J. Inst. Wood Sci. 7: 34-47.

Experiments confirm a previous conclusion that wood density is a function of net assimilation rate, though the effect of low light intensities requires further experimental analysis. Tracheid length appears to be partly determined by the activity of the apical meristem, but there may be more direct effects of temperature and light on tracheid size. The way these factors operate is not yet clear.

427. Dixon, Dorothy.
1961. These are the champs. Amer. Forests 67(2): 41-47.

The largest Sitka spruce is listed as 51 feet, 6 inches in circumference at 4-1/2 feet above the ground, 180 feet tall, and with a crown spread of 50 feet. Location is in the Olympic National Park, Washington.

428. Dodwell, Arthur, and Rixon, Theodore F.
1900. The Olympic forest reserve, Washington. *In* First annual 1899-1900, Part V, forest reserves. U.S. Geol. Surv. 208 pp., illus. (With folded maps.)

429. Dominik, Jan.
1966. Obserwacje nad uszkadzaniem przez owady niektorych gatunkow drzew obcego pochodzenia, rosnacych w lasach doswiadczalnych sggw w Rogowie. [Observations on insect damage to certain exotic tree species in the experimental forests of the Warsaw Agricultural University at Rogow.] Folia Forest. Pol. (Les.) Ser. A12, 175-184. [In Polish.]

430. Doran, William L.
1957. Propagation of woody plants by cuttings. Univ. Mass. Coll. Agr. Exp. Sta. Bull. 491, 99 pp.

Sitka spruce cuttings from current-year wood taken in late winter rooted 100 percent in sand when treated with I.B.A. at 25 milligrams per liter for 24 hours, but not so well when untreated or when taken in the fall.

431. Douglas, David.
1914. Journal kept by David Douglas during his travels in North America, 1823-1827. 364 pp. London: William Wesley & Son.

Describes Sitka spruce under the name *Pinus menziesii*.

432. Douglas Fir Plywood Association.
1960. A recorded voluntary standard of the trade, commercial standard CS 122-60, for western softwood plywood. Ed. 4, 19 pp., illus.

433. Douglass, Bernard S.
1960. Collecting forest seed cones in the Pacific Northwest. USDA Forest Serv. Reg. 6, 21 pp., illus.

Includes practical information on cone collection, testing, and storage for several species including Sitka spruce.

434. Dowell, M. H. D.
1956. The influence of shade on certain tree seedlings, with particular reference to the regeneration of beech. J. Oxford Univ., Forest. Soc. Ser. 4, 4: 32-42.

The effect of decreasing light intensity on tree seedlings was investigated. Root competition was controlled and soil conditions were maintained at optimum level. One-year-old transplants of Sitka spruce and several other species were grown at Kennington Nursery, Oxford, for 1 year in 4 degrees of shade; 0 percent, 34 percent, 54 percent, and 78 percent of the light being excluded. Measurements were made of dry-weight increments, height growth, root/shoot ratios, mortality, leaf weights and lengths. Weed growth was also assessed.

435. Downing, G. L.
1959. Biological evaluation of an Alaska spruce beetle infestation in spruce stands on the Kenai Ranger District. USDA Forest Serv. Alaska Forest Res. Center Forest Insects Surv. Rep. 4, 5 pp.

436. _______
1959. Biological evaluation of the black-headed budworm and hemlock sawfly in the hemlock-spruce stands of southeast Alaska--season of 1959. USDA Forest Serv. Alaska Forest Res. Center Forest Insects Surv. Rep. 5, 3 pp.

437. Downs, Robert Jack.
1962. Photocontrol of growth and dormancy in woody plants, pp. 133-148, illus. *In* Tree growth, Theodore T. Kozlowski [ed.]. New York: Ronald Press Co.

Describes the effect of photoperiod on several species in the Pinaceae, including Sitka spruce. Under the experimental conditions described, Sitka spruce stopped growth on photoperiods of 14 hours or less.

438. Doyle, D. V., McBurney, R. S., and Drow, J. T.
1962. The elastic properties of wood: the moduli of rigidity of Sitka spruce and their relations to moisture content. USDA Forest Prod. Lab. Rep. 1528-B, 7 pp. plus 3 tables, 4 figs.

439. Drew, John, and Pylant, G. D., Jr.
1966. Turpentine from the pulpwoods of the United States and Canada. Tappi 49: 430-438, illus.

Samples of wood chips representing the common species of trees utilized in the pulp and paper industry of the U.S. and Canada were tested to determine yield and composition of volatile turpentine. Sitka spruce yielded 0.12 gallon per ton of dry wood. The main components of the turpentine are described.

440. Drow, J. T.
1945. Effect of hydraulic-equipment oils on the bending and compressive strength of Sitka spruce. USDA Forest Prod. Lab. Rep. 1520, 8 pp. plus 7 tables, 2 figs.

441. _______ and McBurney, R. S.
1946. The elastic properties of wood. Young's moduli and Poisson's ratio of Sitka spruce and their relations to moisture content. USDA Forest Prod. Lab. Rep. 1528-A, 11 pp., illus.

442. Drow, John T.
1945. Effect of moisture on the compressive, bending, and shear strengths, and on the toughness of plywood. USDA Forest Prod. Lab. Rep. 1519, 12 pp., illus.

443. Duffield, John W.
1950. Review of "Sur Quatre Hybrides de Genres Chez les Abietinees," by Mme. Van Campo-Duplan and H. Gaussen. [On four inter-genus hybrids in the Abietineae.] J. Forest. 48: 440.

Discusses the credibility of the hypothesis presented in the article reviewed, that *Tsuga mertensiana* originated as a cross between *Picea* and *Tsuga*.

444. _______
1956. Damage to western Washington forests from November 1955 cold wave. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Res. Note 129, 8 pp., illus.

The mid-November cold wave that occurred throughout the Pacific Northwest caused serious damage to western Washington forests. Western hemlock and western redcedar were damaged most heavily and Douglas-fir somewhat less. Sitka spruce was not damaged seriously, and injury to true firs was slight.

445. _______ and Eide, Rex P.
1950. Polyethylene bag packaging of conifer planting stock in the Pacific Northwest. J. Forest. 57: 578-579.

Douglas-fir, noble fir, grand fir, Pacific silver fir, Sitka spruce, Port-Orford cedar, and western hemlock seedlings are being successfully stored and shipped in kraft-polyethylene bags at the Col. W. B. Greeley Forest Nursery, Nisqually, Wash.

446. Duguid, James D.
1946. Notes on forestry in the Isle of Man. Scot. Forest. J. 60(2): 77-85.

Gives notes on the relative merits of the various species planted by the Forestry Commission. An essential quality is good wind resistance, and Sitka spruce is particularly satisfactory.

447. Dunford, Earl Gerald.
1936. The application of the diameter limit system of cutting to Sitka spruce. 61 pp., illus. (M.S. thesis on file at Yale Univ. Sch. Forest.)

448. Dunn, Malcom.
1892. The value in the British Islands of introduced conifers. J. Roy. Hort. Soc. 14: 73-102.

Abies menziesii (Menzies spruce) or, as it is now called by botanists, *Picea sitchensis*, was introduced by Douglas in 1831. The finest tree recorded in Scotland grows at Castle Menzies and is 46 years old; 96 feet, 6 inches high; and 11 feet in girth. The species was named by Douglas after Archibald Menzies, who first discovered it when accompanying Vancouver on his voyage around the world. Heights and diameters of especially large trees in Britain are mentioned.

449. Durrell, L. W.
[n.d.] Notes on some North American conifers based on leaf characters. Iowa State Coll., Dep. Bot. Contrib. 66: 519-582.

450. Dutton, G. G. S., and Hunt, K.
1958. The constitution of the hemicelluloses of Sitka spruce (*Picea sitchensis*). I. Composition of the hemicellulose and identification of 2-O-(4-O-methyl-D-glucopyranosiduronic acid)-D-xylose. J. Amer. Chem. Soc. 80: 4420-4422.

451. _______ and Hunt, K.
1958. The constitution of the hemicelluloses of Sitka spruce (*Picea sitchensis*). II. Structure of the mannan portion. J. Amer. Chem. Soc. 80: 5697-5701.

Discusses the structural features of glucomannans extracted from the hemicellulose of Sitka spruce.

452. _______ and Hunt, K.
1960. The constitution of the hemicelluloses of Sitka spruce (*Picea sitchensis*). III. Structure of an Arabomenthoxyglucuronoxylan. J. Amer. Chem. Soc. 82: 1682.

453. Eades, H. W.
1932. British Columbia softwoods, their decays and natural defects. Can. Dep. Int. Forest Serv. Bull. 80, 126 pp., illus.

454. _______
1958. Differentiation of sapwood and heartwood in western hemlock by color tests. Forest Prod. J. 8: 104-106.

Perchloric acid, Benedict's solution, or Fehling's solution may be used for Sitka spruce. Reagents for other softwood species, including true firs, Douglas-fir, western redcedar, lodgepole pine, and western hemlock, are described.

455. Eastwood, Alice.
1905. A handbook of the trees of California. Calif. Acad. Sci. Occas. Pap. 9, 86 pp., illus.

456. Edlin, H. L.
1953. The forester's handbook. 394 pp. plus 31 photos. London: Thames & Hudson.

Includes a general description of Sitka spruce in Britain.

457. _______
1964. Forestry in Great Britain. Great Brit. Forest. Comm., 28 pp., illus.

Contains a historical review of forestry in Great Britain and describes present forest policy, with a short review of each of the principal trees grown, including site requirements and statistics. Sitka spruce is the most widely planted exotic conifer in Britain because of its resistance to exposure at high elevations or near the sea, its tolerance to acid peats or heathy vegetation, and its rapid timber production. However, it is susceptible to frost damage in valley bottoms. Rapid height growth is common; many trees exceed 100 feet in 30 years. The timber closely resembles that of Norway spruce. Sitka spruce plantations covered 167,000 acres in 1947; the Forestry Commission plants about 17,000 acres annually.

458. Edlin, Herbert L.
1962. A modern sylva or a discourse of forest trees. 3. The spruces. Quart. J. Forest. 56(4): 292-300.

459. _______ (Ed.)
1964. Forest practice: a summary of methods of establishing forest nurseries and plantations with advice on other forest questions for owners, agents, and foresters. Great Brit. Forest. Comm. Bull. 14, 103 pp.

460. _______
1965. Know your conifers. Great Brit. Forest. Comm. Booklet 15, 56 pp., illus.

461. Edwards, M. V.
1952. The effects of partial soil sterilization with formalin on the raising of Sitka spruce and other conifer seedlings. Great Brit. Forest. Comm. Forest Rec. 16, 20 pp., illus.

Summarizes 5 years of experimental work and reports experimental data. The best commercial formalin treatment was found to be one-tenth gallon per square yard, diluted with nine to 24 times its volume of water. Under proper conditions, treatment increased the growth of first-year seedlings and reduced the growth of weeds. Adverse effects on seedlings were rare. Costs are discussed.

462. _______
1953. Frost damage to Sitka spruce plants in the nursery and its relation to seed origin. Scot. Forest. 7(2): 51.

In Scotland, Sitka spruce from Queen Charlotte Islands is more resistant to frost than plants of U.S. origin. Experience with seedlings from seed collected in older Sitka spruce woods in Scotland suggests that many of these woods are of U.S. provenance.

463. _______
1959. Use of triple superphosphate for forest manuring. *In* Report on forest research for the year ended March 1958. Great Brit. Forest. Comm., pp. 117-130. London: H. M. Stationery Office.

464. _______
1962. The progress of peat land afforestation in Britain. Irish Forest. 19(1): 102-109.

Attempts to raise mixtures of species on peat lands are now less frequent. Lodgepole pine either pure or with a mixture of Japanese or hybrid larch or *Tsuga* rather than Sitka spruce is planted. Several trial forests are being established in the north of Scotland where blanket bog is the prevailing formation.

465. _______ and Holmes, G. D.
1950. Experimental work in the nursery. *In* Report on forest research for the year ended March 1949. Great Brit. Forest Comm., pp. 35-43. London: H. M. Stationery Office.

466. _______ and Holmes, G. D.
1951. Experimental work in the nursery. *In* Report on forest research for the year ended March 1950. Great Brit. Forest. Comm., pp. 12-24. London: H. M. Stationery Office.

467. _______ and Holmes, G. D.
1957. Problems in afforestation. *In* Report on forest research for the year ended March 1956. Great Brit. Forest. Comm., pp. 36-39. London: H. M. Stationery Office.

At Croft Pascoe, on the exposed Lizard Peninsula of Cornwall, afforestation experiments on soils derived from serpentine rock have made a promising start. Broom grows vigorously and will be a useful nurse. Of the many tree species tried, Sitka spruce, lodgepole pine (coastal provenance), *Pinus radiata*, and *P. pinaster* show good early growth.

468. _______, Steward, G. G., and Herman, D. W.
1960. Silvicultural investigations in the forest: (B) Scotland and north England. *In* Report on forest research for the year ended March 1959. Great Brit. Forest. Comm., pp. 38-43. London: H. M. Stationery Office.

Analysis of Norway and Sitka spruce trees blown down in the Inverliever pruning experiments, started 19 years ago, showed no ill effects from the pruning of live branches and illustrated again how thin was the layer of knot-free timber produced during that period. This emphasized the necessity of pruning only the largest, most vigorous trees in a crop, and of starting pruning when their breast-height diameter is about 4 inches (earlier than brashing is usually done).

469. Eire Minister of Lands and Forestry.
1944. Report for the period from 1st April, 1938 to 31st March, 1943. 65 pp.

Armillaria mellea was the most troublesome fungus during the period under review, especially on Sitka spruce.

470. Eis, Slavoj.
1962. Statistical analysis of several methods for estimation of forest habitats and tree growth near Vancouver, B.C. Univ. Brit. Columbia Fac. Forest. Bull. 4, 76 pp., illus.

The analysis includes the hemlock-Sitka spruce type on the southern fringe of the coastal mountain range between Alouette Lake and Howe Sound below the 300-foot elevation. Plant communities were used as a basis for separation of biologically equivalent forest habitats. It was found that almost all the variability of the plant communities studied could be accounted for by differences in soil and in moisture regime. Using only a few environmental characteristics, it was possible to predict both site index and plant community with an accuracy approaching the result obtained using many factors. Mathematical formulas for predicting site index were calculated.

471. Eliot, W. A., and McLean, G. B.
1948. Forest trees of the Pacific coast. New ed., 565 pp., illus. New York: G. P. Putnam's Sons.

472. Elliott, G. K.
1960. The distribution of tracheid length in a single stem of Sitka spruce. J. Inst. Wood Sci. 5: 38-47.

Examines the pattern of variation within a 41-year stem. The variation radially from the pith outward and longitudinally from the stump upward followed the expected pattern laid down in Sanio's laws. A comparison between the effect of age and ring width on tracheid length showed that age had the stronger effect. From a 68-year cross section of another Sitka spruce, age was shown to have a significant effect on tracheid length only in the early years; as the tree matures the effect of age is superseded by that of ring width. (From author's summary.)

473. Ellis, Everett L.
1964. Inorganic elements in wood, pp. 181-189, illus. *In* Cellular ultrastructure of woody plants, Wilfred A. Cote [ed.]. Advance. Sci. Seminar Pinebrook Conf. Center Proc. Syracuse: Syracuse Univ. Press.

474. Elton, E. T. G.
1950. *Dendroctonus micans* Kugel., a pest of Sitka spruce in the Netherlands. Eighth Int. Congr. Entomol. Proc. 1948: 759-764.

Since its appearance in the Netherlands in 1935, *D. micans* has generally been found as a primary pest on Sitka spruce. Natural enemies have so far rarely been found attacking it and are unlikely to give complete control. The rotation period of the tree will probably be limited to about 40 years by *D. micans* attack.

475. Embry, R. S.
1963. Prescribed burning for seedbed improvement. Thirteenth Alaska Annu. Sci. Conf. Proc. 1962: 88.

476. Embry, Robert S.
1964. What happens to nonmerchantable trees left after clearcutting? Northern Forest Exp. Sta. USDA Forest Serv. Res. Note NOR-7, 3 pp.

The study indicated a 5-year survival rate of 51 percent. Wind and logging damage caused greatest mortality. Diameter growth was good, but height growth was poor. Trees produced cones but the quality and quantity of seed are not known.

477. _______ and Haack, Paul M.
1965. Volume tables and equations for young-growth western hemlock and Sitka spruce in southeast Alaska. Northern Forest Exp. Sta. USDA Forest Serv. Res. Note NOR-12, 21 pp.

478. Enari, Leonid.
1956. Plants of the Pacific Northwest. 315 pp., illus. Portland, Oreg.: Bindfords & Mort.

479. Enderlein, Horst, and Vogl, Michael.
1966. Experimentelle untersuchumgen uber die SO_2 - empfindlickeit der Nadeln verschiedener Koniferen. [Experimental observation of the SO_2 resistance of various conifer needles.] Arch. Forstwesen 15(11/12): 1207-1224, illus. [In German. English summary.]

480. Engelhardt, N. T.
1957. Pathological deterioration of looper-killed western hemlock on southern Vancouver Island. Forest Sci. 3: 125-136.

481. Englerth, George H.
1947. Decay of Sitka spruce in southeastern Alaska. J. Forest. 45: 894-900, illus.

Decay was studied in 630 trees on 11 plots. Data on age and size of trees and kinds and amounts of decay were recorded. The more important fungi found on living Sitka spruce were *Polyporus schweinitzii*, *P. borealis*, *P. sulphureus*, *Fomes pinicola*, *F. pini*, *F. officinalis*, and *Lentinus kaufmannii*. Sporophores of these fungi, excepting *F. pini*, were produced infrequently or not at all on living trees. No swollen knots were observed in association with *F. pini* infections. In most cases, frost cracks, injuries caused by falling trees, or broken tops provided the only indication of the presence of decay.

482. Erickson, R. W., and Hossfeld, R.
1964. Effect of cationic and nonionic fluorocarbon surfactants on the permeability of wood to water. Tappi 47: 792-795, illus.

Sitka spruce was used as the experimental material.

483. Erteld, W.
1953. Uber die zukünftige Arbeit auf dem Gebiet der Ertragskunde. [Future work in the study of yield.] Arch. Forstwesen 2(4/5): 432-442. [In German.]

484. _______
1960. Bericht uber das in der Zeit vom 21.bis 28.9, 1959 in Eberswalde abgehaltene Ertragskundliche Symposium. [Report on the yield-studies symposium at Eberswalde, Sept. 21-28, 1959.] Arch. Forstwesen 9(4): 305-325. [In German.]

485. Eule, H. W.
1962. Forschungsbeiträge zur forstlichen Photogrammetrie II. Das Verhältnis der Kronengrösse zum Brusthöhendurchmesser und zur Derbholzmasse an Einselstämmen. [The relation of crown size to d.b.h. and volume of individual stems.] Allg. Forstzeitschrift 17(1/2): 31-33. [In German.]

Describes preliminary measurements of Sitka spruce and beech in mixture with even-aged or older Scots pine or oak. When the trees were divided into height classes, correlations between crown diameter and diameter breast height were fairly close for both species; correlations with volume were even closer and approached linearity.

486. Evan, W. David D.
1952. Afforestation of wasteland. J. Land Agents Soc. 51(1): 43-44.

Describes the successful afforestation of spoil banks from a sand and gravel quarry with Sitka spruce and unrooted cuttings of *Populus robusta*.

487. Evans, Russell Stewart.
1951. Studies on holocellulose of Sitka spruce; dilute acid hydrolysis. 40 pp. (M.S. thesis on file at Univ. Brit. Columbia.)

488. Eyre, Samuel Robert.
1963. Vegetation and soils, a world picture. 324 pp., illus. Chicago: Aldine Publishing Co.

489. Fabricius, O.
1926. Douglas- og Sitkagran. [Douglas and Sitka spruce.] Dansk Skovforenings Tidsskr. 3: 405-541. [In Danish.]

Describes experience with Sitka spruce planted in Denmark.

490. Fagerlund, Gunnar O.
1965. Olympic National Park - Washington. U.S. Dep. Int. Nat. Park Serv. Natur. Hist. Handbook 1, 60 pp., illus.

Describes Sitka spruce in the park. The species is common only in the rain forest on the west side. Large trees are 225 to 300 feet tall and 5 to 8 feet in diameter. The largest known specimen is 13 feet, 4 inches in diameter, located about 4 miles above the Hoh Ranger Station.

491. Fairbairn, W. A.
1966. Measurements of light intensity. *In* Report on forest research for the year ended March 1965. Great Brit. Forest. Comm., p. 131. London: H. M. Stationery Office.

Describes light intensity measured in openings of various sizes in several Sitka spruce stands in Britain.

492. ______
1967. Light relation of six tree species in the nursery and in the forest. *In* Report on forest research for the year ended March 1967. Great Brit. Forest. Comm., pp. 154-155. London: H. M. Stationery Office.

493. Farquhar, J.
1966. The use of seedlings for forest planting in Scotland and north England. *In* Report on forest research for the year ended March 1965. Great Brit. Forest. Comm., pp. 154-168. London: H. M. Stationery Office.

Survival and height growth of 1-year seedlings of several species including Sitka spruce were poorer than for transplants, and results were less reliable. The use of 1-year seedlings is not recommended.

494. Farrer, R. P.
1951. The use of selective herbicides in forestry in general and in nursery work in particular. Empire Forest. Rev. 30(1): 66-71.

495. Faulkner, R.
1955. Experiments on applying various forms of nitrogen to Sitka spruce seedbeds in Scotland. *In* Report on forest research for the year ended March 1954. Great Brit. Forest. Comm., pp. 91-101. London: H. M. Stationery Office.

Summarizes long-term fertilization trials using nitrochalk, flash, formalized casein, and other materials. Of those tested, nitrochalk was considered most suitable and economical for seedbeds.

496. ________ 1956. Green crops compared with hopwaste as heathland nursery treatments. Great Brit. Forest. Comm. Res. Br. Pap. 19, 10 pp.

Experiments carried out with Sitka spruce showed that, in the first year on new heathland or woodland nursery sites, the main limiting factors to seedling growth are lack of N, P, and K. They also showed that a first-year green crop of oats, grown with the aid of artificial fertilizers and followed by seedbed dressings of NPK fertilizers at standard rates, can provide a stimulus to Sitka spruce seedlings equal to and more consistent than that provided by compost followed by similar rates of NPK fertilizer. Comparative costs and benefits are discussed.

497. ________ 1957. Experiments on seedbed compaction. *In* Report on forest research for the year ended March 1956. Great Brit. Forest Comm., pp. 113-123. London: H. M. Stationery Office.

Investigates the effect of various degrees of seedbed compaction, before and after sowing, on height growth and total yield of seedlings. Sitka spruce was used in all tests. The results indicate that compaction with a roller before sowing gives maximum yield of seedlings. Compaction hastens germination but does not greatly affect height growth. Slightly firming the seed into the seedbed surface and rolling after applying grit covers have little effect on growth and yield of seedlings.

498. ________ 1957. The storage of one-year conifer seedlings. *In* Report on forest research for the year ended March 1956. Great Brit. Forest. Comm., pp. 85-95. London: H. M. Stationery Office.

499. ________ 1958. Investigations into intensive methods of raising conifer seedlings. Empire Forest. Rev. 37(1): 85-95.

Trials in Scotland showed that four crops of Sitka spruce seedlings per year could be raised in a frame with soil temperature (at 2 inches) maintained at 65-70°F. and with artificial illumination extended into the night, but because of difficulties in hardening-off the seedlings, it is impracticable to raise more than two or three crops per year.

500. ________ 1958. Scottish experiments comparing chloropicrin with formalin as a partial soil sterilizer for conifer seedbeds. *In* Report on forest research for the year ended March 1957. Great Brit. Forest. Comm., pp. 159-170. London: H. M. Stationery Office.

Summarizes the results of experiments started in 1953 at a number of nurseries. It was found that chloropicrin injected into nursery beds is usually a slightly more effective sterilizing agent than formalin, as shown by height growth and yield of usable 1-year seedlings of Sitka spruce. Time of application and costs are discussed.

501. _______
1958. Summer, autumn or spring lining out? Scot. Forest. 12(3): 127-134.

June and July lining out gave a higher yield of usable transplants and compared favorably with March, the usual period. Lining out in late autumn gave the lowest numbers of usable transplants.

502. _______
1960. Summary of recent research into phosphate and potash manuring of conifers in nursery seedbeds in Scotland and northern England. *In* Report on forest research for the year ended March 1959. Great Brit. Forest. Comm., pp. 126-140. London: H. M. Stationery Office.

Summarizes the results of a long series of experiments. There is no danger in applying P or K fertilizers on the day of sowing if they are well mixed with the soil. Equally good results are obtained if applied earlier, up to 16 weeks before sowing. The currently recommended rate of 14 pounds of superphosphate per 100 square yards of nursery bed is satisfactory for Japanese larch, western hemlock, and Douglas-fir, but for Sitka spruce 1-1/2 to 2 times this amount is recommended. For all four species, applications of K_2SO_4 at 4 to 5 pounds per 100 square yards are generally adequate.

503. _______
1960. Summary of recent research into nitrogen manuring of conifers in nursery seedbeds in Scotland and northern England. *In* Report on forest research for the year ended March 1959. Great Brit. Forest. Comm., pp. 141-160. London: H. M. Stationery Office.

504. _______
1965. Seed orchards in Britain. *In* Report on forest research for the year ended March 1964. Great Brit. Forest. Comm., pp. 211-218. London: H. M. Stationery Office.

505. _______
1967. Procedures used for progeny-testing in Britain with special reference to forest nursery practice. Great Brit. Forest. Comm. Forest Rec. 60, 22 pp., illus.

506. _______ and Aldhous, J. R.
1956. Nursery investigations. *In* Report on forest research for the year ended March 1955. Great Brit. Forest. Comm., pp. 16-32, illus. London: H. M. Stationery Office.

507. _______ and Aldhous, J. R.
1957. Nursery investigations. *In* Report on forest research for the year ended March 1956. Great Brit. Forest. Comm., pp. 19-35. London: H. M. Stationery Office.

508. _______ and Aldhous, J. R.
1957. Nursery investigations. *In* Report on forest research for the year ended March 1957. Great Brit. Forest. Comm., pp. 19-36. London: H. M. Stationery Office.

509. _______ and Aldhous, J. R.
1959. Nursery investigations. *In* Report on forest research for the year ended March 1958. Great Brit. Forest. Comm., pp. 20-37. London: H. M. Stationery Office.

510. _______ and Aldhous, J. R.
1960. Nursery investigations. *In* Report on forest research for the year ended March 1959. Great Brit. Forest. Comm., pp. 18-32. London: H. M. Stationery Office.

511. _______, Herbert, R. B., and Fletcher, A. M.
1965. Forest genetics. *In* Report on forest research for the year ended March 1964. Great Brit. Forest. Comm., pp. 53-56. London: H. M. Stationery Office.

512. _______, Herbert, R. B., and Fletcher, A. M.
1966. Forest genetics. *In* Report on forest research for the year ended March 1965. Great Brit. Forest. Comm., pp. 59-60. London: H. M. Stationery Office.

A total of 131 candidate Sitka spruce plus trees have been selected. Sitka spruce has been a difficult species to propagate from cuttings or by grafting. Recent results from August-September tests showed 60-percent rooting of cuttings taken from the 12th internode from the top of the trees and treated with a mild indole acetic acid rooting hormone powder.

513. _______, Herbert, R. B., and Fletcher, A. M.
1967. Forest genetics. *In* Report on forest research for the year ended March 1966. Great Brit. Forest. Comm., pp. 66-69. London: H. M. Stationery Office.

514. _______, Herbert, R. B., and Fletcher, A. M.
1967. Forest genetics. *In* Report on forest research for the year ended March 1967. Great Brit. Forest. Comm., pp. 91-95. London: H. M. Stationery Office.

A total of 332 candidate Sitka spruce plus trees have been selected, and propagation in tree banks by grafting is now keeping abreast of the rate of selection. A national tree bank was started at Wauchope Forest, Roxburghshire, Scotland. Data on success of vegetative propagation are given. An attempt to grow Sitka spruce progenies under glass for more than one growing season was unsuccessful because plants developed abnormally in the second year. The problem appears to be associated with a winter-chilling requirement.

515. _______ and Holmes, G. D.
1952. Experimental work in nurseries: composting and trials of composting. *In* Report on forest research for the year ended March 1951. Great Brit. Forest. Comm., pp. 20-21. London: H. M. Stationery Office.

516. _______ and Holmes, G. D.
1954. Experimental work in nurseries. *In* Report on forest research for the year ended March 1953. Great Brit. Forest. Comm., pp. 17-31. London: H. M. Stationery Office.

517. Faull, J. H.
1934. A remarkable spruce rust, *Peridermium parksianum* n. sp. J. Arnold Arboretum 15: 86-87.

518. Fensom, K. G.
1959. The characteristics and significance or spruce. Can. Forest Prod. Lab., 22 pp. plus 4 tables.

Discusses identification, mechanical and chemical properties, uses (including drying and preservation), potential demand, etc., for five species of spruce including Sitka spruce.

519. Fernow, B. E.
1902. The forests of Alaska. Forest. & Irrig. 8: 66-70.

520. ________
1910. The forests of Alaska. *In* History, geography, resources, Harriman Alaska Series, Vol. 2. Smithsonian Inst. Pub. 1991, pp. 235-256, illus. (Formerly privately printed in 1902 as Harriman Alaska Expedition, New York: Doubleday Page & Co.)

521. Ferré, Y. de.
1952. Les formes de jeunesse des Abiétacees: ontogénie-phylogénie. [The form, ontogeny, and phylogeny of young *Abies*.] Fac. Sc. Toulouse, vol. 1, et Trav. Lab. Forest de Toulouse tome 2, vol. 3, art. 1, 282 pp., illus. [In French.]

Describes purported intergeneric cross: *Picea sitchensis* X *Tsuga heterophylla*.

522. Finch, H. D. S.
1957. New ways of using the general tariff tables for conifers. Great Brit. Forest Res. Forest. Comm. Rec. 32, 11 pp.

523. Findlay, W. P. K.
1934. Studies in the physiology of wood-destroying fungi. The effect of nitrogen content upon the rate of decay of timber. Ann. Bot. (London) 48: 109-117.

Low concentration of ammonium nitrate slightly increased the rate of decay of blocks of Sitka spruce heartwood. Addition of an organic source of nitrogen markedly increased fungal growth.

524. Fitzpatrick, H. M.
1965. Conifers: keys to the genera and species, with economic notes. Roy. Soc. Sci. Proc. (Dublin) 2(7): 67-129 plus 6 plates.

525. Flensborg, C. E.
1950. Fra Islands Skovsag. [Forestry in Iceland.] Hedeselskabets Tidsskr. Viborg 71(3): 47-59, illus. [In Icelandic.]

Describes the progress of forestry in Iceland during the last 50 years and gives details of some experimental plantings including Sitka spruce.

526. Fligg, D. M.
1960. Imperial yield tables. Brit. Columbia Forest Serv. Forest Surv. Note 6, 13 pp. plus tables.

Tables presented are based on additional information and supplement those included in the 1957 continuous forest inventory of British Columbia.

527. _______ and Breadon, R. E.
1959. Log position volume tables. Brit. Columbia Forest Serv. Forest. Surv. Note 4, 8 pp. plus tables.

Presents regional information on the average cubic-foot volume in 32-foot logs, according to their position in trees, of five conifer species, including Sitka spruce, by diameter and total height. Also indicates possible log grade, according to size requirements only, for each log position in trees of varying species, and size.

528. Flohr, W.
1959. Waldbauliche Richtlinien für die Bewirtschaftung der Wälder im mecklenburgischen Grund- und Endmoränengebiet. [Correct silviculture for the management of the forest of the ground-and-end morain region of Mecklenburg.] Arch. Forstwesen 8(2): 85-160. [In German. English summary.]

529. Forbes, A. C.
1914. The Sitka spruce in Ireland. Roy. Scot. Arboricult. Soc. Trans. 28(2): 264-265.

530. Forest Club, University of British Columbia.
1959. Forestry handbook for British Columbia. 800 pp., illus. Vancouver: Univ. Brit. Columbia.

Pages 567-568 list silvical characteristics of Sitka spruce.

531. Foster, R. E., and Foster, A. T.
1953. Estimating decay in western hemlock: suggested aids to the management of mature hemlock-spruce forest on the Queen Charlotte Islands. Brit. Columbia Lumberman 37(10): 42-47, illus.

532. Fowells, H. A. (Comp.).
1965. Silvics of forest trees of the United States. U.S. Dep. Agr. Handbook 271, 762 pp., illus.

Contains a summary of information on the silvics of Sitka spruce, including its relationship to climate, soils, topography, and associated species and a description of its life history from seedling stage to maturity.

533. Francke-Grosmann, H.
1948. Rotfäule und Riesenbastkäfer, eine Gefahr fur die Sitkafichte auf Öd-und Ackerlandaufforstungen Schleswig-Holsteins. [Red rot and giant bark beetle, a threat to Sitka spruce in afforestations on waste and arable land in Schleswig-Holstein.] Forst- und Holzwirtsch. 23: 232-235. [In German.]

Sitka spruce was more severely infected by *Fomes annosus* than was *Picea abies*. The invasion of a single main root is followed by exudation of resin on the bark of the trunk and thinning of the crown. Infection makes the trees more susceptible to attack by *Dendroctonus micans*.

534. _______
1954. Populations dynamische Faktoren bei der Massenvermehrung des *Dendroctonus micans* Kug. an der Sitkafichte in Schleswig-Holstein. [Factors affecting mass outbreaks of *D. micans* on Sitka spruce in Schleswig-Holstein.] Verhandl. Deut. Ges. angew. Entomol. e. V. (Frankfurt A. M.) 1952: 108-117, illus. [In German.]

Describes insect parasites on a pest which attacks chiefly trees weakened by *Fomes annosus*. Discusses dry weather and enemies as possible causes of population fluctuations. No relation was found between susceptibility to attack and stand density or light conditions.

535. _______
1954. Feinde und Krankheiten der Sitkafichte auf nordeutschen Standorten. [Pests and diseases of Sitka spruce on north German sites.] Forst- und Holzwirtsch. 9 A [6]: 117-119. [In German.]

536. _______
1954. Über Wurzel - und Stockfäulen der Sitkafichte auf norddeutschen Standorten. [About root and stem rots of Sitka spruce on north German sites.] Eleventh Congr. Int. Union Forest Res. Organ. Proc. (Rome) 1953, sect. 24, no. 2/2, pp. 649-655. [In German.]

537. _______
1956. Kleinschmetterlinge als Schadlinge der Sitkafichten auf Standorten Schleswig-Holsteins. [Small lepidoptera as pests of Sitka spruce on sites in Schleswig-Holstein.] Twelfth Congr. Int. Union Forest. Res. Organ. Proc. (Oxford) 1956: 192-194. [In German.]

Reports on injuries to terminal shoots in 8- to 15-year-old Sitka spruce plantations by *Dioryctria abietella*, and to lateral shoots in a 15-year-old plantation by *Steganoptycha ratzeburgiana*, both observed on the island of Fohr.

538. _______
1962. Ungewohnliche knospenschaden an Sitkafichten. [Unusual injuries to buds of Sitka spruce.] Eleventh Int. Congr. Entomol. Proc. 1960 (2): 189-191. [In German.]

Describes injuries caused by *Lygus rubicatus* (a mirid) and *Trisetacus grosmanni* (a recently discovered eriophyid) in Schleswig-Holstein.

539. _______ and Ruhm, W.
1954. Die Bekampfung des Riesenbastkafers (*Dendroctonus micans* Kug.). [The control of *D. micans*.] Z. Weltforstwirtschaft 17(2): 48-53, illus. [In German. English summary.]

Outlines the occurrence of *D. micans* on *Picea glauca*, *P. abies*, and *P. sitchensis* in Schleswig-Holstein, its biology, habits, and symptoms of attack, and discusses chemical control. The felling and debarking of infested trees has proved ineffective.

540. Francke-Grosmann, Helene.
1950. Die gefährdung der Sitkafichte durch rotfäule (*Fomes annosus* Fr.) und riesenbastkäfer (*Dendroctonus micans* Kug.) in aufforstungsrevieren Schleswigs. [Danger to Sitka spruce from *F. annosus* and *D. micans* in afforestation areas of Schleswig.] Eighth Int. Congr. Entomol. Proc. 1948: 773-778 plus 2 photos. [In German.]

Discusses the status of *D. micans* as a primary and secondary (succeeding *F. annosus*) pest of Sitka spruce and describes the progress of the attack.

541. _______
1950. Uber ein Massenvorkommen von *Gilletteella*-Gallen an Sitkafichten (*Picea sitchensis* Carr.). [An outbreak of *Gilletteella* galls on Sitka spruce.] Anz. Schadlingskunde 23(1): 3-6, illus. [In German.]

542. Frankland, Edward P.
1956. Dermatitis from handling conifers. Quart. J. Forest. 50(3): 244-245.

Records the occurrence of dermatitis in a worker in a Sitka spruce plantation.

543. Franklin, Jerry F.
1961. A guide to seedling identification for 25 conifers of the Pacific Northwest. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta., 65 pp., illus.

Describes appearance of Sitka spruce seedlings at the end of their first growing season.

544. Fraser, A. I.
1962. The soil and roots as factors in tree stability. Forestry 35(2): 117-127.

Effects of drainage and peat depth on the rooting and stability of 34-year-old Sitka spruce were studied at Forest of Ae in Dumfries and Kielder Forest of Northumberland. It was concluded that relatively small increases in rooting depth obtained by drainage of peat soils can produce considerable increase in resistance to blowdown. Drainage also increased the mechanical strength of the soil. On a freely drained site, Sitka spruce developed a vertical root system, and it is not completely correct to consider it a shallow-rooted species.

545. _______
1965. Wind stability: tree-pulling investigations. *In* Report on forest research for the year ended March 1964. Great Brit. Forest. Comm., pp. 35-36. London: H. M. Stationery Office.

546. _______
1965. The uncertainties of wind-damage in forest management. Irish Forest. 22(1): 23-30.

Wind damage to Sitka spruce and other plantations in Britain can be reduced by recognition of high hazard areas and silvicultural treatment to reduce the hazard. Soil condition is a major factor in tree stability, and soil mapping, particularly to identify poorly drained soils, is desirable. Soil drainage is recommended depending on age and height of plantations. Sitka spruce growing on deep soils should be thinned early and regularly.

547. _______ and Gardiner, J. B. H.
1967. Rooting and stability in Sitka spruce. Great Brit. Forest. Comm. Bull. 40, 27 pp., illus.

Describes investgations in north Wales and the English-Scottish borders. The effect of nutrients, drainage, stand characteristics, and topography are discussed.

548. _______ and Henman, D. W.
1966. Tree stability. *In* Report on forest research for the year ended March 1965. Great Brit. Forest. Comm., pp. 44-46. London: H. M. Stationery Office.

549. _______ and Neustein, S. A.
1967. Regeneration of tree stands. *In* Report on forest research for the year ended March 1967. Great Brit. Forest. Comm., pp. 55-59. London: H. M. Stationery Office.

550. _______ and Neustein, S. A.
1967. Tree stability. *In* Report on forest research for the year ended March 1967. Great Brit. Forest. Comm., pp. 74-76. London: H. M. Stationery Office.

551. _______ and Taylor, G. T. M.
1967. Cultivation and drainage. *In* Report on forest research for the year ended March 1966. Great Brit. Forest. Comm., pp. 43-47. London: H. M. Stationery Office.

552. Fraser, George K.
1936. Cairnhill Plantation, Durris: An example of variation in the rate of tree-growth resulting from differences in soil. Forestry 10: 110-123, illus., plus 2 plates.

553. Freas, A. D., and Selbo, M. L.
1954. Fabrication and design of glued laminated wood structural members. U.S. Dep. Agr. Tech. Bull. 1069, 220 pp., illus.

554. Freeman, Otis, and Upton, Rolland H.
1957. Washington State resources. 210 pp., illus. Seattle: Wash. State Resource Comm.

555. Frey, R. W., and Clarke, I. D.
1941. Tannin content of Sitka spruce bark. J. Amer. Leather Chem. Ass. 36: 576-584, illus.

The average tannin content of 31 samples of Sitka spruce bark from Washington and Oregon was 24.1 percent, the individual results varying from 11.2 to 37.2 percent. Tannin content was related both to position in tree and age of tree, increasing with height from the ground and, at least for bark near the butt end, decreasing with age of tree. The tannin is of the catechol type. Total sugars in the bark ranged from 3.3 to 12.4 percent, increasing with height from the ground and decreasing slightly with age of tree. Sitka spruce bark is very thin and would give a low yield per tree, so a large volume of tanning extract could not be produced from this source alone.

556. Friedrich, Alexander Gunther.
1951. Untersuchungs-ergebnisse zum "Alten und Neuen" über die Sitkafichte (*Picea sitchensis* Carr.). [Results of past and present researches on Sitka spruce.] Forest- und Holz 6(3): 37-38. [In German.]

The susceptibility of Sitka spruce to attack by *Fomes annosus* and (subsequently) *Dendroctonus micans*, makes it inadvisable to plant it in mixture with other species also subject to *F. annosus* attack. In coastal areas with high rainfall, Sitka spruce gives good results when planted on windy and water-logged sites. Mixed stands on such sites should be well tended and watched for *F. annosus*.

557. Fröhlich, H. J.
1957. Züchtungsarbeiten im Lehrforstamt Gahrenberg. [Tree breeding in the Gahrenberg Instructional Forest.] Forstarchiv 28(8/9): 170-175, illus. [In German.]

Describes provenance trials, begun about 30 years ago, of several species, including Sitka spruce. Some growth data are given and a brief note is included on current aims in breeding work.

558. Froland, Age.
1962. Gjødsling av plantefelter på Vestlandet. Noen foreløpige resultater fra gjødslingsforsøkene i ytre strøk. [Initial fertilization of plantations in West Norway. Some preliminary results from experiments in the coastal districts proper.] Tidsskr. Skogbruk 70(1): 14-35, illus. [In Norwegian. English summary.]

559. Fullaway, S. V., Jr., Johnson, Herman M., and Hill, C. L.
1928. The air seasoning of western softwood lumber. U.S. Dep. Agr. Dep. Bull. 1425, 60 pp., illus.

560. Funk, A.
1965. A new parasite of spruce from British Columbia. Can. J. Bot. 43(1): 45-48 plus 6 photos.

Botryosphaeria piceae n. sp. is a parasite which causes perennial cankers of Sitka and Engelmann spruce in British Columbia. The affected branches may remain alive for many years. The fungus has been found only in the sexual state, producing ascospores chiefly in early spring. (From author's summary.)

561. Gale, B.
1947. Observations from the Isle of Man. Quart. J. Forest. 47(1): 16-19.

562. Gallagher, G.
1967. Spacing; thinning. Dep. Lands, Ireland, Forest Div. Forest Res. Rev. 1957/64: 66-75.

563. Gannett, Henry.
1902. The forests of Oregon. U. S. Geol. Surv. Prof. Pap. 4, 36 pp., illus.

564. Garman, E. H.
1957. The occurrence of spruce in the interior of British Columbia. Dep. Lands & Forests, Brit. Columbia Forest Serv. Tech. Pub. T-49, 31 pp., illus.

565. ———
1963. Pocket guide to the trees and shrubs of British Columbia. Ed. 3. Brit. Columbia Forest Serv. Pub. B-28, 137 pp., illus.

566. Gaskill, Alfred.
1913. Specific gravity and weight of the most important American woods. Forest. Quart. 11(4): 527-530.

Specific gravity of Sitka spruce is listed as 0.38, and weight is 24 pounds per cubic foot.

567. Gass, Charles R., Billings, Richard F., Stephens, Freeman R., and others.
1967. Soil management report for the Hollis area. USDA Forest Serv. Tongass National Forest, Alaska Region, 118 pp., illus.

Describes soils on a portion of Prince of Wales Island, Alaska. Western hemlock, Sitka spruce, western redcedar, and Alaska-cedar are the dominant trees in the forested zone, which extends from sea level to 1,500 feet. Average percentage of tree species in old-growth stands is tabulated by soil types.

568. Gerry, Eloise.
1942. Radial streak (red) and giant resin ducts in spruce. USDA Forest Serv. Forest Prod. Lab. Rep. 1391, 2 pp., illus.

569. Gibbs, R. Darnley.
1958. The Maule reaction, lignins, and the relationships between woody plants, pp. 269-312. *In* The physiology of forest trees, K. V. Thimann, W. B. Critchfield, and M. H. Zimmermann [eds.]. New York: The Ronald Press Co.

Sitka spruce showed a negative reaction to the test.

570. Gibson, Henry H.
1913. Sitka spruce. (*Picea sitchensis*.), pp. 133-135. *In* American forest trees, Maxwell Hu [ed.]. Chicago: Hardwood Record.

571. Gibson, W. N.
1951. Forestry in northern Ireland. Forestry 24(2): 152-158.

The progress made in forestry under the Ministry of Agriculture since 1921 is discussed, and conditions are compared with other parts of the United Kingdom. Sitka spruce is the main species being established and is ideally suited to the climate and soils over the greater part of northern Ireland. Some exceptionally fine stands have been produced on heavy clay loams, and growth rates and timber volumes probably compare favorably with any in the British Isles.

572. _______ and Brown, N. M.
1962. The history and future of forestry in the Middle Tweed. Forestry 35(2): 105-115 plus 2 photos.

573. Gifford, David.
1964. Studies on soil microarthropod populations in Scottish forests. *In* Report on forest research for the year ended March 1963. Great Brit. Forest. Comm., pp. 164-172. London: H. M. Stationery Office.

574. Gifford, E. R.
1959. Soil fauna research. *In* Report on forest research for the year ended March 1958. Great Brit. Forest. Comm., p. 116. London: H. M. Stationery Office.

Reports effects of establishing a Sitka spruce plantation on a population of soil-inhabiting mites.

575. Gilpin, W. J.
1965. The relation of crown width to D.B.H. and total height in open and forest grown Sitka spruce. 39 pp. (B.S. in Forest. thesis on file at Univ. Brit. Columbia.)

The relation of crown width to diameter at breast height and total height for open and forest grown Sitka spruce was examined. Three characteristics of open grown and forest grown trees were assessed by computer analysis. Multiple regression equations for estimation of crown width of open grown and forest grown trees were developed. Analysis of variance showed most of the variation in crown width could be accounted for by total height in both open and forest grown trees.

576. Gladman, R. J., and Greig, B. J. W.
1965. Principal butt rots of conifers. Great Brit. Forest. Comm. Booklet 13, 8 pp. plus 10 plates.

A forester's guide to the three most common and damaging decays of standing conifers in Great Britain, caused by *Fomes annosus*, *Armillaria mellea*, and *Polyporus schweinitzii*. Descriptions and illustrations show the gross characteristics of the fungi, and the rots they cause. (Some illustrations are in color.)

577. Glaser, H.
1955. Untersuchungen über die chemische Entrindung und ihre Anwendbarkeit in deutschen Wäldern. [Investigations on chemical barking and its applicability in German forests.] 87 pp., illus. Frankfurt-am-Main: J. D. Saverlander. [In German.]

Briefly surveys experimental work and experience gained in chemical debarking in countries outside Germany and includes a detailed description of the author's own tests in Germany over the period 1950-53. Sitka spruce peeled easily after chemical treatment.

578. Gockerell, E. C.
1966. Plantations on burned versus unburned areas. J. Forest. 64: 392-394.

Clearcut areas were examined for comparison of plantations of Sitka spruce and other conifers on burned and unburned units. Planted stocking is greater on burned areas, but there are fewer natural seedlings than on unburned areas. Average height of trees is greatest on unburned areas. Browsing by elk and deer is heaviest on burned areas.

579. Godman, R. M.
1949. What kind of trees make the best growth in southeast Alaska. USDA Forest Serv. Alaska Forest Res. Center Tech. Note 2, 1 p.

The average second-growth stand in southeast Alaska is composed of approximately equal proportions by volume of Sitka spruce and western hemlock. Remeasurement of four sample plots after 20 years showed that spruce increment is far greater than hemlock. Both species increase their rate of growth as they increase in diameter. Spruce outstrips hemlock in every vigor class.

580. _______
1951. Thinning second-growth hemlock-spruce for pulpwood. USDA Forest Serv. Alaska Forest Res. Center Tech. Note 7, 1 p.

Reports on a test of two thinning methods: leaving 120 crop trees per acre, and leaving two-thirds of original basal area.

581. _______
1952. A classification of the climax forests of southeastern Alaska. J. Forest. 50: 435-438.

Presents a classification scheme for the climax forests of southeast Alaska, a component of which is Sitka spruce. The average number of 16-foot logs to a 6-inch top diameter inside bark of trees in and above the average stand diameter was found to be the most practical single indicator of stand characteristics in the climax forests. Log height is roughly indicative of species composition. The stands are described in detail.

582. _______
1953. Seed dispersal in southeast Alaska. USDA Forest Serv. Alaska Forest Res. Center Tech. Note 16, 2 pp.

A bumper cone crop in 1951 produced 91 pounds of seed per acre in a western hemlock-Sitka spruce stand in the Juneau area of the Tongass National Forest. Seed fall by month is tabulated.

583. _______
1953. Moss retards regeneration in southeast Alaska. USDA Forest Serv. Alaska Forest Res. Center Tech. Note 18, 1 p.

584. _______
1953. Seasonal distribution of leader growth. USDA Forest Serv. Alaska Forest Res. Center Tech. Note 19, 2 pp.

585. _______
1953. Seasonal distribution of radial growth. USDA Forest Serv. Alaska Forest Res. Center Tech. Note 20, 1 p.

Radial growth at breast height began about May 15 in the Ketchikan area of the Tongass National Forest. For old-growth Sitka spruce, 50 percent of the increment was complete in 7-1/2 weeks, and appeared to terminate at 17 weeks. For second-growth spruce, 90 percent of the increment was complete in 11-1/2 weeks and growth was essentially complete by the 14th week. Weekly periodic and cumulative percentages of radial increment for old-growth and second-growth Sitka spruce, western hemlock, and western redcedar are given.

586. _______ and Gregory, R. A.
1953. Physical soil characteristics related to site quality in climax stands of southeast Alaska. USDA Forest Serv. Alaska Forest Res. Center Tech. Note 17, 1 p.

587. Godman, Richard M., and Gregory, Robert A.
1955. Seasonal distribution of radial and leader growth in the Sitka spruce-western hemlock forest of southeast Alaska. J. Forest. 53: 827-833.

Tables and graphs show weekly radial growth changes using Daubenmire's dendrometer for second-growth Sitka spruce, western hemlock, and western redcedar at Juneau and Hollis. Leader growth is included and the growing seasons are divided into the number and percent of days in which the growth occurs.

588. Godske, C. L.
1962. Investigations carried through at the station of forest meteorology at OS. III. On the relationship between air temperature and leading shoot increment for different coniferous trees. Arbok Univ. Bergen Mat., Natur. Ser. 15, 1961: 34.

589. Godwin, G. E.
1956. The Society's visit to Denmark. Forestry 29(2): 137-146.

Briefly describes forests and forest practices in Denmark. Several Sitka spruce stands were seen during the tour.

590. _______
1956. A major threat to Sitka spruce? Quart. J. Forest. 50(2): 119-123.

Dendroctonus (hylesinus) micans has spread alarmingly in Sitka spruce in Denmark since 1947 and killed whole plantations. It is as yet unknown in Great Britain, but its nearness gives some grounds for apprehension. (Author's summary.)

591. Gøhrn, V.
1962. Fortegnelse over nogle egnede importområder for skovfrø til anvendelse I Dansk kovbrug. [List of some suitable areas from which to import seeds for use in Danish forestry.] Dansk Skovforenings Tidsskr. 47(9): 401-427. [In Danish.]

592. _______, Petersen, B. Beier, and Henriksen, H. A.
1954. *Dendroctonus micans* angriffe und ihr verhaltnis zum durchforstungsgrad bekampfungsversuche. [Attacks by *D. micans*

and their relationship to thinning grade.] Eleventh Congr. Int. Union. Forest. Res. Organ. Proc. (Rome) 1953, Sect. 24, no. 2/3, pp. 656-663. [In German.]

Research in a dune plantation of Sitka spruce in Denmark showed that *D. micans* spread most rapidly into moderately and heavily thinned areas. Laboratory tests suggested that lead arsenate might be used as a stomach poison, but results of field experiments were generally unsuccessful. The biology and development of the insect are discussed.

593. Goldthwait, Richard P.
1963. Dating the little ice age in Glacier Bay, Alaska. Int. Geol. Congr. Rep., 21st Sess., Norden, 1960. Part 27: 37-46.

594. Goodey, J. B.
1965. The relationships between the nematode *Hopolaimus uniformis* and Sitka spruce. *In* Experiments on nutrition problems in forest nurseries, Blanche Benzian [ed.]. Great Brit. Forest. Comm. Bull. 37, 1: 210-211.

Results offer circumstantial evidence of possible damage to Sitka spruce nursery seedlings by parasite eelworms, particularly *H. uniformis*.

595. Gould, C. W.
1920. Commercial woods of the Pacific coast. Timberman 21: 34-39.

Includes information on annual wood production, estimated stands, uses, properties, and physical characteristics of several Pacific coast species including Sitka spruce.

596. Graham, K.
1951. The Sitka spruce weevil. Div. Forest. Biol. Dep. Agr. Can., Bi-mon. Progr. Rep. 7(5): 3-4.

597. Graham, R. D.
1956. The preservative treatment of eight Oregon conifers by pressure processes. Amer. Wood Preserv. Ass. Proc. 52: 117-138.

Air-dried crosstie sections of eight conifers, including Sitka spruce, were incised and pressure treated with a creosote-petroleum solution, using the full-cell, Lowry, and Rueping processes. Recommendations for treating each species are made. (From author's summary.)

598. Graham, Robert D.
1954. The air seasoning and preservative treatment of crossties from eight Oregon conifers. Amer. Wood Preserv. Ass. Proc. 50: 175-184.

Treatment with a coal-tar creosote-petroleum solution resulted in part solid black and part ringed penetration into Sitka spruce crossties for a total depth averaging 0.84 inch. There appeared to be no difference in treatability of heartwood and sapwood.

599. _______ and Miller, Donald J.
1964. Service life of treated and untreated fence posts. Oreg. State Univ. Forest Res. Lab., 24 pp.

Untreated Sitka spruce posts lasted for 6 years.

600. Graham, Samuel Alexander.
1952. Forest entomology. Ed. 3, 351 pp., illus. New York, Toronto, etc.: McGraw-Hill Book Co.

601. Grant, Donald.
1915. Classification of moorland at Fersit for purposes of planting. Roy. Scot. Arboricult. Soc. Trans. 29: 73-76 plus 1 plate.

602. Grant, John A., and Grant, Carol L.
1943. Trees and shrubs for Pacific Northwest gardens. 335 pp., illus. Seattle: Frank McCaffrey, Dogwood Press.

603. Graves, H. S.
1916. The forests of Alaska. Timberman 17(6): 33-37, illus.

604. Graves, Henry S.
1916. The forests of Alaska. Amer. Forest. 22(1): 24-37, illus.

605. Gray, H. R.
1956. The form and taper of forest-tree stems. Imp. Inst., Oxford Univ. Inst. Pap. 32, 79 pp.

Discusses sectional area-to-height relationship for the main stem of various forest-grown trees including Sitka spruce.

606. Great Britain Forest Products Research Board (London).
1951. Wood-water relationships. Great Brit. Forest Prod. Res. Board Rep. 1950: 12-13.

Measurements of the relative-humidity: moisture-content isotherms of Sitka spruce are shown in graphs, where absorption and desorption curves correspond to moisture content from dryness to 32.5 percent and back again.

607. ________
1951. The bending of tropical timbers. Great Brit. Forest Prod. Res. Board Rep. 1950: 22.

608. ________
1952. Electrical properties of wood. Great Brit. Forest Prod. Res. Board Rep. 1951: 51-53.

Describes a study of the effect of moisture content, grain direction and frequency on dielectric constant and loss tangent for Sitka spruce and several other woods.

609. ________
1952. Research on pruning. Great Brit. Forest Prod. Res. Board Rep. 1951: 55-56.

Some 2,900 pruned knots in British-grown Sitka and Norway spruce logs were examined from 76 trees and 29 localities. Measurements of over 1,200 of these knots have shown an average radial healing thickness of just under 0.5 inch of wood. Dissection showed no obviously diseased knots or wood, but symptoms were found in the bark similar to those associated with attack by *Stereum sanguinolentum* or other fungi: It is recommended that green pruning of spruce be avoided in Britain.

610. ______ 1953. Seasoning in superheated steam. Great Brit. Forest Prod. Res. Board Rep. 1952: 12-13.

611. ______ 1953. The structural use of timber. Great Brit. Forest Prod. Res. Board Rep. 1952: 16-17.

612. ______ 1953. Determination of arsenic in wood and foliage. Great Brit. Forest Prod. Res. Board Rep. 1952: 46-47.

Results of analyses, after the removal of the organic matter by digesting the samples with an acid mixture, showed very little arsenic present in needles and wood of Sitka spruce subjected to two different treatments with arsenic applied to standing trees to facilitate bark removal.

613. ______ 1953. Diffusion of water vapour through wood. Great Brit. Forest Prod. Res. Board Rep. 1952: 48-49.

Compares grade and strength of Sitka spruce from Scotland and from Kent.

614. ______ 1954. Softwood mannan. Great Brit. Forest Prod. Res. Board Rep. 1953: 43.

A polysaccharide containing mannose and glucose units only has been isolated from Sitka spruce.

615. ______ 1958. Effect of gamma rays on the hygroscopicity of wood. Great Brit. Forest Prod. Res. Board Rep. 1957: 46.

Sitka spruce specimens were exposed to gamma rays from Co^{60} at dosage levels of 1, 10, and 100 million radiation, and the equilibrium moisture content curves were then determined. Very heavy doses of radiation are needed to affect hygroscopicity (and possibly other physical properties), and the effect is negligible below 10 million radiation.

616. ______ 1959. Wood bending: solid bending. Dir. Great Brit. Forest Prod. Res. Board Rep. 1958: 10.

Experiments to determine the bending properties of nine British-grown softwoods, including Sitka spruce, and ash indicated that they were intrinsically superior to many tropical hardwoods tested, but their gross properties and commercial values were adversely affected by knots.

617. ______ 1960. Home-grown timber investigations. Dir. Great Brit. Forest Prod. Res. Board Rep. 1959: 5.

Mentions a special instrument designed for measuring the inclination of the grain in cross-sectional disks. This will be used in a study of variations in anatomical structure of Sitka spruce throughout the United Kingdom.

618. ________ 1961. *Ambrosia* (pinhole borer) and *Lymexylid* beetles. Damage in coniferous forests, Argyllshire. Dir. Great Brit. Forest Prod. Res. Rep. 1960: 30-31.

619. ________ 1961. Effect of specimen size on swelling. Dir. Great Brit. Forest Prod. Res. Rep. 1960: 42-43.

620. ________ 1962. Common furniture beetle (*Anobium punctatum*): biology, habits, and nutrition. Dir. Great Brit. Forest Prod. Res. Rep. 1961: 21.

A decrease in nutritional suitability from the bark toward the center in British-grown Sitka spruce was demonstrated by the insertion of larvae into sample blocks and a study of their development.

621. ________ 1962. Prevention and control of infestation. Ambrosia beetles. Dir. Great Brit. Forest Prod. Res. Rep. 1961: 24.

622. ________ 1962. Effect of pre-compression on strength. Dir. Great Brit. Forest Prod. Res. Rep. 1961: 31.

623. ________ 1964. Home-grown timber investigations: compression wood in Sitka spruce. Dir. Great Brit. Forest Prod. Res. Rep. 1963: 9-10.

624. ________ 1964. Special apparatus and techniques. Betaray method of density determination. Dir. Great Brit. Forest Prod. Res. Rep. 1963: 10.

Reports on continued work using the C^{14}B-particle technique to examine the density variation in Sitka spruce early wood with a view to selecting trees of above-average density. Preliminary results suggest that early wood density is not necessarily related to the rate of diameter growth and that some fast-growing stems may have early wood of adequate quality.

625. ________ 1964. Home-grown investigations. Wind damage in Sitka spruce. Dir. Great Brit. Forest Prod. Res. Board Rep. 1963: 10.

The bulges on one side of the stem, found in 30-year Sitka spruce that had broken off at 8- to 10-foot height, consisted of fast-grown compression wood overlaying a natural compression failure and associated ring shake apparently caused by bending in gales 2 years before.

626. ________ 1964. Timber mechanics. Quality and properties of home-grown timbers. Dir. Great Brit. Forest Prod. Res. Board Rep. 1963: 34-35.

Gives results of strength tests on green Norway and Sitka spruce.

627. _______
1966. Pulping of home-grown timbers. Great Brit. Forest Prod. Res. Board Rep. 1965: 18-19.

628. Great Britain Forest Products Research Laboratory (Princes Risborough).
1934. Preliminary note on the timber of home-grown Sitka Spruce (*Picea sitchensis* Carr). Forestry 8: 126-130, illus.

629. _______
1941. Grading softwoods for strength; stress-grades for beams. Great Brit. Forest Prod. Res. Lab. Leafl. 19, 7 pp., illus.

630. _______
1945. A handbook of Empire timbers. Rev., 142 pp. London: H. M. Stationery Office.

631. _______
1953. Trials of timber for plywood manufacture. Small-scale tests on: consignment 750, Scots pine; consignment 763, Sitka spruce. Great Brit. Forest Prod. Res. Lab. Progr. Rep. 21, 11 pp.

Gives data on processing trials, gluing properties, and veneer quality.

632. _______
1953. Properties of thinnings of home-grown Sitka spruce (*Picea sitchensis*). Great Brit. Forest Prod. Res. Lab. Progr. Rep. 1--Consignment 761, 12 pp. plus 9 figs.

Gives data on the following: rate of growth as shown by ring width; density; wood structure; conversion and quality of converted timber; grading; strength properties; seasoning properties and suitable schedules; durability and preservative treatment; and working properties. The timber proved to be fast-grown, with low specific gravity. The soft early wood, broad in comparison with the late wood, tears when sawn or worked with cutting tools, giving a poor finish. The timber is unsuitable for joinery. There was no appreciable collapse in seasoning, but pressure during preservative treatment caused collapse.

633. _______
1953. Properties of thinning of home-grown Sitka spruce (*Picea sitchensis*). Great Brit. Forest Prod. Res. Lab. Progr. Rep. 2--Consignment 763, 15 pp., illus.

The 49-year-old wood was from Gravetye Forest, Sussex. It was fast grown for the first 25 years, and averaged 10 or more rings per inch in the outer half. The report compares wood properties with that grown under different conditions elsewhere. The soft early wood tore when sawn or worked with a cutting tool but was more satisfactory than that from Inverliever. There was a large percent of grade II material and 1.4 percent of grade I. There was no appreciable collapse in seasoning, but collapse occurred during preservative treatment under pressure. The parcel was superior to that from Inverliever except for larger knots.

634. ________
1956. Combined report on the properties of thinnings of home-grown Sitka spruce (*Picea sitchensis*). Great Brit. Forest Prod. Res. Lab., 11 pp. plus 8 figs.

Describes wood structure, conversion, grading, and strength tests of thinnings from several plantations. In general, the wood was grown too fast for many uses.

635. ________
1957. Properties of thinnings of home-grown Sitka spruce (*Picea sitchensis*). Great Brit. Forest Prod. Res. Lab. Progr. Rep. 7--Consignment 879, 55 pp. plus 1 fig.

This consignment is considered separately because the wood is from a plantation seriously underthinned and growth rate was slow. Similar in specific gravity to faster grown timber, it showed higher values in equivalent fiber stress at maximum load, modulus of elasticity and compression parallel to the grain, a considerably lower value for hardness, and a slightly lower one for impact bending strength. Differences in growth rate made no appreciable difference in wood quality.

636. ________
1957. A handbook of softwoods. Dep. Sci., Ind. Res., 73 pp. London: H. M. Stationery Office.

Describes Sitka spruce trees, wood seasoning, and uses, in Canada and Great Britain.

637. ________
1958. Report on the properties of four different provenance consignments of Sitka spruce. Great Brit. Forest Prod. Res. Lab., 20 pp., illus.

Five trees, 30 years old, grown in Radnorshire were tested from each of four provenances: (1) Queen Charlotte Islands, (2) Mt. Olympus, Wash., (3) Siuslaw, Oreg., and (4) Siskiyou, Calif. Timber from (1) had the highest density and highest quality; differences in density between trees from the other three sources were not significant. (3) was less dense than (2) or (4). Trees from (3) were most subject to drought-crack but there was little difference between provenances in seasoning collapse. It is concluded that seed from northern provenances, especially that from (1), is preferable in timber quality.

638. ________
1967. Home-grown timbers - Sitka and Norway spruce. Great Brit. Forest Prod. Res. Board Rep. 1967: 5-6.

639. Great Britain Forestry Commission.
1930. Forestry commission yield tables for Scots pine and other conifers. 24 pp. London: H. M. Stationery Office.

Contains yield tables and height curves for Scots pine, European and Japanese larch, Norway and Sitka spruce, and Douglas-fir.

640. ______
1937. Spring frosts. Great Brit. Forest. Comm. Bull. 18, 131 pp., illus.

641. ______
1946. The thinning of plantations. Great Brit. Forest. Comm. Forest Oper. Ser. 1, 40 pp.

642. ______
1948. Broom as nurse to Sitka spruce. *In* Report on forest research for the year ended March 1947. Great Brit. Forest. Comm., p. 38. London: H. M. Stationery Office.

Reports striking results of using broom, *Cytisus scoparius*, on difficult moorland sites. Trees with broom nurses were growing well and fast, whereas those without remained in check or grew very slowly. A similar effect has been observed with Scots pine as a nurse for Sitka spruce, but this is slower in developing.

643. ______
1958. Forestry practice; a summary of methods of establishing forest nurseries and plantations with advice on other forestry questions for owners, agents, and foresters. Great Brit. Forest Res. Forest. Comm. Rep. 14, 93 pp.

644. ______
1967. Forty-seventh annual report of the Forestry Commissioners for the year ended Sept. 30, 1966. Great Brit. Forest. Comm., 75 pp. plus 8 plates.

Lists source and amount of Sitka spruce seed imported and number of nursery plants sold to the trade, forest year 1966. Earlier reports give similar information.

645. ______
1967. Vegetative propagation. *In* Report on forest research for the year ended March 1967. Great Brit. Forest. Comm., pp. 92-93. London: H. M. Stationery Office.

646. ______
1967. Normal yield tables for Sitka spruce, yield classes 80 and 60 and Norway spruce yield class 80. Suppl. 1 to Forest Management tables booklet 16. Great Brit. Forest. Comm. (London).

647. ______
1967. Fomes annosus: a fungus causing butt rot, root rot and death of conifers. Great Brit. Forest. Comm. Leafl. 5, 11 pp., illus.

An account of the life history, method of infection, damage, and control of the fungus.

648. Greeley, A. W.
1954. Alaska's acres at work...at last. Amer. Forests 60(10): 8-11, 52.

649. Greeley, W. B.
1920. Utilization of the forests of Alaska. Science N.S. 52(1341): 244.

650. ________
1921. Paper from American trees. Nat. Bus. 9(3): 39-40.

651. Green, George Rex.
1933. Trees of North America (exclusive of Mexico). Vol. 1, The conifers. 186 pp. Ann Arbor: Edward Bros., Inc.

652. Green, R. G., and Wood, R. F.
1957. Manuring of conifer seedlings directly planted in the forest. *In* Report on forest research for the year ended March 1956. Great Brit. Forest. Comm., pp. 132-139. London: H. M. Stationery Office.

653. Grefnes, Martin W.
1940-41. Alaska: pulp and paper possibilities. Timberman 42(12): 26, 28, 30, 32.

654. Gregory, P. H.
1963. Diseases of Sitka spruce seedlings. Rothamsted [England] Exp. Sta. Rep. 1962: 122-123.

655. Gregory, R. A.
1956. The effect of clearcutting and soil disturbance on temperatures near the soil surface in southeast Alaska. USDA Forest Serv. Alaska Forest Res. Center Sta. Pap. 7, 22 pp., illus.

Measurements were made in the forest and in a clearcut area, on plots with undisturbed moss cover or where the organic and mineral soils had been mixed. Air and soil temperatures were considerably increased during late spring and summer as a result of timber cutting. Open soils warmed earlier and cooled earlier and more rapidly than forested soils, and the difference in soil temperature was still appreciable at a depth of 24 inches. No injury to Sitka spruce seedlings from excessive heat or frost was observed. Moss-covered seedbeds proved less desirable than disturbed soils for germination and early survival, but once seedling roots were established in the moist layers below the moss, chance of survival seemed good. Germination in disturbed soils was earlier and more concentrated. Germination in the forest was late and prolonged, and seedlings were still in the succulent stage at the end of the growing season.

656. ________
1957. 1956 cone crop report for Alaska tree species. USDA Forest Serv. Alaska Forest Res. Center Tech. Note 35, 2 pp.

657. ________
1957. The accuracy of southeast Alaska site index estimates associated with variable numbers of height measurements. USDA Forest Serv. Alaska Forest Res. Center Tech. Note 38, 2 pp.

Estimates of site index tended to be higher when Sitka spruce was used for height measurements than when western hemlock was used. The difference increased as site index increased. Below site index 100 the difference was negligible.

658. _______
1957. A comparison between leader growth of western conifers in Alaska and Vancouver Island. USDA Forest Serv. Alaska Forest Res. Center Tech. Note 36, 2 pp.

The pattern of leader growth of western hemlock in southeast Alaska was similar to that recorded on Vancouver Island. Growth of Sitka spruce in Alaska stopped abruptly and earlier than that of western hemlock.

659. _______
1958. 1957 cone crop report for Alaska tree species. USDA Forest Serv. Alaska Forest Res. Center Tech. Note 41, 2 pp.

660. _______
1959. 1958 cone crop report for Alaska tree species. USDA Forest Serv. Alaska Forest Res. Center Tech. Note 44, 2 pp.

661. Gregory, Robert A.
1960. The development of forest soil organic layers in relation to time in southeast Alaska. USDA Forest Serv. Alaska Forest Res. Center Tech. Note 47, 3 pp.

The unincorporated organic layer was sampled on the Maybeso Experimental Forest, Prince of Wales Island, beneath a mature stand of western hemlock more than 300 years old, and under Sitka spruce stands about 230 and 125 years old. Average depth in inches and oven-dry weight in pounds per acre of the organic layer under stands of decreasing age were 6.20 and 235,418; 4.02 and 165,608; 1.59 and 47,916.

662. _______
1960. Estimating site index in sapling and pole stands in southeast Alaska. USDA Forest Serv. Alaska Forest Res. Center Tech. Note 48, 3 pp.

Presents a method for determining site index of young Sitka spruce by measurement of a six-node span.

663. Greguss, Pal.
1955. Identification of living gymnosperms on the basis of xylotomy. 263 pp., illus. Budapest: Akad. Kiado. [In German.]

Provides anatomical key and illustration of Sitka spruce wood.

664. Greig, B. J. W.
1962. *Fomes annosus* (Fr.) Cke, and other root-rotting fungi in conifers on ex-hardwood sites. Forestry 35(2): 164-182, illus.

The development of root and butt rot caused by *F. annosus* in Sitka spruce and other conifer crops planted on ex-hardwood ground is slower than that in second-rotation conifer plantations. This is apparently due to competition from other fungi, notably *Armillaria mellea*. Excavations on ex-hardwood sites showed that *F. annosus* was present in conifer thinning stumps, and that transference of infection occurred, causing butt rot. The investigations confirmed the need for stump protection of all conifer crops planted on ex-hardwood sites. Short accounts are given of the activity of

A. mellea and *Polyporus schweinitzii*, the other two important root-rotting fungi on these sites. (From author's summary.)

665. ________
1967. Honey fungus. (Rev.) Great Brit. Forest. Comm. Leafl. 6, 10 pp., illus.

The honey fungus *Armillaria mellea* (Vahl. ex. Fr.) is a root parasite occurring commonly in British woods. Sitka spruce is very susceptible and in some stands almost every tree is attacked. The discussion includes descriptions and life history, detection methods, relative susceptibility of tree species, conditions favoring infection, and method of prevention.

666. Griffin, D. M.
1957. Fungal damage to roots of Sitka spruce seedlings in forest nurseries. *In* Report on forest research for the year ended March 1956. Great Brit. Forest. Comm., pp. 86-87. London: H. M. Stationery Office.

Investigation of root systems of Sitka spruce and other conifer seedlings in nurseries, before and after partial sterilization, indicate that damage by fungal pathogens is insufficient to account for the poor growth of seedlings in such nurseries. It seems likely that much of the beneficial effect of partial sterilization is due to changes in the amount and nature of available nitrogen.

667. ________
1958. Influence of pH on the incidence of damping-off. Trans. Brit. Mycol. Soc. 41(4): 483-490, illus.

Using *Beta vulgaris*, *Brassica campestris*, *Picea sitchensis*, and *Pinus contorta* as hosts and *Pythium ultimum* as parasite over a wide range of soil reactions, it was ascertained that the main factor in changes in incidence of damping-off with change in soil pH is the vigor of the host as expressed in growth rate during the susceptible period. Sitka spruce showed a strong negative correlation between incidence of disease and growth rate.

668. ________
1965. A study of damping-off, root damage and related phenomena in coniferous seedlings in British forest nurseries. *In* Experiments on nutrition problems in forest nurseries, Blanche Benzian [ed.]. Great Brit. Forest. Comm. Bull. 37, 1: 212-227, illus.

Pythium spp., especially *P. ultimum*, are the main agents of damping-off of Sitka spruce and other conifers in British forest nurseries. The disease is largely limited to established nurseries with alkaline or near-neutral soil reaction and can be controlled by partial soil sterilization.

669. Griffith, B. G.
1940. Effect of indolebutyric acid, indoleacetic, and alpha napthaleneacetic acid on rooting of cuttings of Douglas-fir and Sitka spruce. J. Forest. 38: 496-501, illus.

Dormant cuttings of Douglas-fir and Sitka spruce were successfully rooted (80 and 100 percent, respectively) by treating with either indoleacetic or indolebutyric acid. Indolebutyric acid was more effective for stimulating root development than either indoleacetic or x-naphthalene acetic acid. The most effective dosage for Sitka spruce was 25.0 parts per million for 24-hour treatment periods. Treatment during the period February 20 to March 30 gave best results for both species.

670. Griggs, R. F.
1914. Observations on the edge of the forest in the Kodiak region of Alaska. Torrey Bot. Club Bull. 41: 381-385.

The edge of the range of Sitka spruce is advancing westward rapidly across Kodiak Island.

671. _______
1936. The vegetation of the Katmai district. Ecology 17(3): 380-417, illus.

672. Griggs, Robert F.
1915. The effect of the eruption of Katmai on land vegetation. Amer. Geogr. Soc. Bull. 47: 193-203, illus.

673. _______
1918. The recovery of vegetation at Kodiak. Ohio J. Sci. 19(1): 1-57.

Describes recovery of plants, including Sitka spruce, after the eruption of Mt. Katmai.

674. _______
1922. The Valley of Ten Thousand Smokes. 341 pp., illus. Washington: Nat. Geogr. Soc.

675. _______
1934. Botany.--The problem of arctic vegetation. J. Wash. Acad. Sci. 24(4): 153-175.

676. _______
1934. The edge of the forest in Alaska and the reason for its position. Ecology 15(2): 80-96.

The advance of Sitka spruce across Kodiak Island, Alaska, is a long-term secular migration into new territory rather than a phase of a cyclic oscillation back and forth.

677. _______
1946. The timberlines of northern America and their interpretation. Ecology 27(4): 275-289, illus.

Describes Sitka spruce at the extreme western limit of its range in Alaska.

678. Gruineil, T. de.
1956. A note on peat afforestation with special reference to work carried out in Cloosh Valley, Connemara. Irish Forest. 13(2): 64-68.

On the basis of his own experience the author's recommendations for establishing a tree crop on Connemara peat are (1) drain intensively and prepare ground 6 months to a year before planting; (2) plant 1 + 1 *Picea sitchensis*, 1 + 1 broadleaved species; (3) apply ground mineral phosphate immediately after planting, at a rate of 3 ounces per plant for spruce and birch and 1 ounce for pine.

679. Guernsey, F. W.
1948. Wood waste as a source of pulp on the Pacific coast. Brit. Columbia Lumberman 23(9): 66, 107-108, 110-112.

680. Guiguet, C. J.
1953. An ecological study of Goose Island, British Columbia, with special reference to mammals and birds. Brit. Columbia Prov. Mus. Occas. Pap. 10, 78 pp., illus.

On Goose Island two plant associations are included in the general heading of coniferous forest; the typical coast climax association of western redcedar, western hemlock, and Sitka spruce, and an association that includes western redcedar and western hemlock with lodgepole pine, Alaska-cedar, and Pacific yew. The latter is a stunted forest forming an ecotone between spruce-hemlock and muskeg associations, and also predominates in rocky areas. Floral composition is described by the Aldous method.

681. Guillebaud, W. H.
1933. Experiments on the ages and types of nursery stock for planting out. Forestry 7: 73-84.

682. _______
1942. Investigation on the rate of drying of pit-props. Forestry 16: 13-31, illus.

683. _______ and Hummel, F. C.
1949. A note on the movement of tree classes. Forestry 23(1): 1-14, illus.

An investigation was made to find how tree classes (dominant, codominant, subdominant, and suppressed) are represented in pure, even-aged crops at different ages and under different thinning treatments, and to what extent individual trees tend to maintain or change their relative position in the canopy during the life of a stand. The species investigated included Sitka spruce.

684. Guinier, P.
1939. Utilization en papeterie du bois de trois coniferes Americains cultivés dans l'est de la France (Épicéa de Sitka, Sapin de Vancouver, Sapin de Douglas). [The utilization for papermaking of three American conifers planted in the east of France (*Picea sitchensis*, *Abies grandis*, and *Pseudotsuga douglasii*).] Du Comité des Forets Bull., pp. 748-761. [In French.]

685. Haack, Paul M.
1963. Volume tables for hemlock and Sitka spruce on the Chugach National Forest, Alaska. Northern Forest Exp. Sta. USDA Forest Serv. Res. Note NOR-4, 4 pp.

Volume tables are in board feet, Scribner Decimal C., and in cubic feet.

686. Haarløv, N., and Petersen, B. B.
1952. Temperaturmålinger i bark og ved af Sitkagran (*Picea sitchensis*) med saerlig henblik på temperaturen i gångsystemer af Hylesinus (*Dendroctonus*) micans. [Temperature measurements in bark and wood of *P. sitchensis* with particular reference to the temperature in tunnels of *D. micans*.] Forstl. Forsøgsv. Danmark 21(1): 43-91. [In Danish. English summary.]

687. Hachenberg, F.
1957. Misserfolge von Ausländeranbauten bei falscher Standortswahl. [Failures with exotics tried on unsuitable sites.] Holz-Zentralbl. 83(99): 1211-1212, illus. [In German.]

Sitka spruce planted in the Kastellaun district (Hunsruck) on badly aerated soils in the 1880's and 1890's showed heavy losses from frost and snow and made poor growth.

688. ______
1957. Bericht über diverse Ausländeranbauten im Forstamt Kastellaun/Hunsrück. [Report on various exotics in the Kastellaun Hunsruck forest district.] Allg. Forstzeitschrift 12(18/19): 234-236, illus. [In German.]

Describes the progress of Sitka spruce and other species planted between 1882 and 1890.

689. Haddock, Phillip G.
1961. Silvicultural views on the Canadian spruce forests. Forest. Chron. 37(4): 376-389.

690. ______
1961. Coniferous shade trees in suburban development. Thirty-seventh Nat. Shade Tree Conf. Proc. 1961: 147-159.

In rich well-watered soil, Sitka spruce might prove to be a successful shade tree but its use is not recommended because of insect pests, which are very troublesome, particularly under cultivation.

691. ______
1964. Intellectual prospecting report. Univ. Brit. Columbia Fac. Forest., 15 pp.

Describes a 5-week trip to Europe by the author in 1964. Sitka spruce plantations in Denmark, Norway, and Great Britain are described briefly. General impressions regarding silvicultural philosophy in Europe are given.

692. ______
1966. Information available for other western species having sufficient generality to be applied to Douglas-fir seed movement problems. Western Forest Genet. Ass. Proc. 1966: 8-22.

Contains a review of literature on provenance experience in Europe with several western conifers, including Sitka spruce.

693. Hagem, Oscar.
1931. Forsek med Vestamerikanske Traeslag. [Studies on western America tree species.] Medd. Vestlandet Forstl. Forsoekssta. 12, 4(2): 1-217, illus.

Describes Sitka spruce trials in Norway with provenances from Alaska, British Columbia, Washington, and California.

694. Halliday, W. E. D.
1937. A forest classification for Canada. Can. Forest Serv. Dep. Mines, Resources Bull. 89, 50 pp. plus map.

Sitka spruce is associated with western redcedar and western hemlock in the coast forest region, especially toward the northern portion of the region.

695. _______ and Brown, A. W. A.
1943. The distribution of some important forest trees in Canada. Ecology 24(3): 353-373.

Presents a series of maps showing the distribution of important forest trees, among them Sitka spruce.

696. Halvorsen, Birger.
1965. Kvalitetsegenskaper hos enkelte fremmede treslag. [Properties of wood of some exotic tree species.] Norsk Skogindustri 19(8): 310-314, illus. [In Finnish.]

697. Hanahoe, A. J.
1948. Extraction of conifer seed at Avondale, County Wicklow. Irish Forest. 5(1/2): 9-17.

An account of the design and operation of a kiln for extracting conifer seed, and comparative figures of the cost of imported and home-collected and extracted seed.

698. Hansbrough, J. R.
1934. Occurrence and parasitism of *Aleurodiscus amorphus* in North America. J. Forest. 32: 452-458, illus.

Sitka spruce is listed as a host for the fungus *Aleurodiscus amorphus*.

699. _______ and Englerth, G. H.
1944. The significance of the discolorations in aircraft lumber: Sitka spruce. U.S. Dep. Agr. Forest Pathol. Spec. Release 21, 14 pp.

700. Hansen, Carl.
1892. Pinetum danicum. Conifers collected and observed by Professor Carl Hansen, Mynstersvei 2, Copenhagen V. J. Roy. Hort. Soc. 14: 257-480.

701. Hansen, Henry P.
1938. Postglacial forest succession and climate in the Puget Sound region. Ecology 19(4): 528-542, illus.

702. _______
1940. Paleoecology of two peat bogs in southwestern British Columbia. Amer. J. Bot. 27: 144-149, illus.

703. _______
1941. Paleoecology of two peat deposits on the Oregon coast. Studies in Botany. Oregon State Univ. Monogr. 3, 31 pp., illus.

704. _______
1941. Further pollen studies of post Pleistocene bogs in the Puget lowlands of Washington. Torrey Bot. Club Bull. 68(3): 133-148, illus.

705. _______
1941. Paleoecology of a bog in the spruce-hemlock climax of the Olympic Peninsula. Amer. Midland Natur. 25: 290-297, illus.

706. _______
1943. A pollen study of two bogs on Orcas Island, of the San Juan Islands, Washington. Torrey Bot. Club Bull. 70(3): 236-243.

707. _______
1943. Paleoecology of two sand dune bogs on the southern Oregon coast. Amer. J. Bot. 30: 335-340.

708. _______
1947. Postglacial forest succession, climate, and chronology in the Pacific Northwest. Amer. Phil. Soc. Trans. New ser. vol. 37, part 1, 126 pp., illus.

Presents a reconstruction and analysis of postglacial vegetation by pollen analysis of sedimentary columns taken from peat bogs. Present day observations indicate that Sitka spruce succeeds lodgepole pine, and in turn is succeeded by western hemlock on dunes and other sandy areas. Spruce also precedes hemlock on mature peat bogs, indicating that it can thrive under less favorable conditions. Plant succession has been interrupted from time to time by accelerated sand movement, which permitted lodgepole pines periodically to regain predominance. There is little indication on the coastal strip of a climate drier and warmer than the present at any time during the postglacial period. The principal cause of change in forest composition has been the periodic shifting of sand, disrupting succession toward the climax vegetation.

709. _______
1950. Pollen analysis of three bogs on Vancouver Island. Can. J. Ecol. 38(2): 270-276, illus.

710. _______
1953. Postglacial forests in the Yukon Territory and Alaska. Amer. J. Sci. 251: 505-542, illus.

711. _______ and Allison, Ira S.
1942. Pollen study of a fossil peat deposit on the Oregon coast. Northwest Sci. 16(4): 86-92, illus.

712. _______ and Mackin, J. Hoover.
1949. A pre-Wisconsin forest succession in the Puget lowland, Washington. Amer. J. Sci. 247: 833-855, illus.

713. Hansen, J. E.
1957. Zu: Kann der Riesenbastkäfer (*Dendroctonus micans* Kug.) in Schleswig-Holstein erfolgreich bekämpft werden? [A note on: Can *D. micans* be successfully controlled in Schleswig-Holstein?] Forst- und Holzwirt 12(10): 167-168. [In German.]

The author considers nutrient deficiencies to be the chief cause of susceptibility to beetle attack in Sitka spruce, and reports on the application of nitrogen at the rate of 300 kilograms per hectare with the Ruhr-Stickstoff forest roller in a poor stand on sand with a thick raw-humus layer. Soil improvement was rapid, and all but two very heavily infested trees recovered.

714. Hanson, H. C.
1951. Characteristics of some grassland, marsh, and other plant communities in western Alaska. Ecol. Monogr. 21(4): 317-375.

The study included Sitka spruce and white spruce stands. Compared with grassland stands, the soil was shallower, rocks were more numerous on or near the surface, the soil showed more podzolization, and the root systems were shallower.

715. Hanson, H. S.
1951. Forest entomology. *In* Report on forest research for the year ended March 1950. Great Brit. Forest. Comm., pp. 83-91. London: H. M. Stationery Office.

The study of aphid and other insect pests of Sitka spruce was continued. Although formerly the green spruce aphis, *Neomyzaphis abietina*, was considered to be the only important insect enemy of Sitka spruce, 12 species of insect are now known to cause serious damage to current-year foliage. Where several pests occur in the same area, it seems probable that the combined effects of their attack on young crops may prevent satisfactory growth, whereas in their absence the trees might continue to make satisfactory recovery from the effects of *Neomyzaphis* attack.

716. _______
1952. Forest entomology. The green spruce aphis, *Neomyzaphis abietina* (Walker). *In* Report on forest research for the year ended March 1951. Great Brit. Forest. Comm., pp. 98-107. London: H. M. Stationery Office.

717. Hanson, P. D.
1960. Alaska--last frontier. Western Conserv. J. 16(4): 78-81, illus.

718. Hanzlik, E. J.
1925. A site classification scheme for the western Cascades forest region. Univ. Wash. Forest Club Quart. 4(1): 5-8.

719. Hanzlik, Edward John.
1928. Trees and forests of Western United States. 128 pp. Portland, Oreg.: Dunham Printing Co.

720. Hard, J. S.
1967. Identification of destructive Alaska forest insects. Inst. Northern Forest. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta., 19 pp., illus.

721. Haring, Robert C., and Massie, Michael R. C.
1966. A survey of the Alaskan forest products industry. Univ. Alaska Res. Monogr. 8, 147 pp., illus.

722. Harlow, William M., and Harrar, Elwood S.
1958. Textbook of dendrology. Ed. 4, 561 pp., illus. New York: McGraw-Hill Book Co.

723. Harrar, E. S.
1957. Hough's encyclopaedia of American woods. 204 pp., illus. New York: Robert Speller & Sons.

Describes the tree and wood, including gross diagnostic features and minute anatomy, physical and mechanical properties, and uses.

724. Harris, A. S.
1960. 1959 cone crop report for Alaska tree species. USDA Forest Serv. Alaska Forest Res. Center Tech. Note 50, 2 pp.

725. ________
1962. Cone crops in coastal Alaska - 1960 and 1961. USDA Forest Serv. Alaska Forest Res. Center Tech. Note 53, 4 pp., illus.

726. ________
1963. Tree reproduction development on a mile-square clearcutting. (Abstr.) Thirteenth Annu. Alaska Sci. Conf. Proc. 1962: 87.

727. ________
1964. Sitka spruce--Alaska's new State tree. Amer. Forests 70(8): 32-35.

728. ________
1965. Aerial seeding Sitka spruce and western hemlock on a cutover area in southeast Alaska. Northern Forest Exp. Sta. USDA Forest Serv. Res. Note NOR-10, 6 pp., illus.

Aerial seeding combined with natural seedfall resulted in adequate initial stocking of cutover areas. Approximately 60 live seeds were needed to produce each seedling surviving at the end of the first growing season.

729. ________
1966. Effects of slash burning on conifer regeneration in southeast Alaska. Northern Forest Exp. Sta. USDA Forest Serv. Res. Note NOR-18, 6 pp., illus.

Slash burning after clearcutting of an old-growth western hemlock-Sitka spruce stand favored the establishment of Sitka spruce. Fewer seedlings were established on the burned than on the unburned test area, but distribution was more uniform on the burn. The higher percentage of spruce after slash burning stemmed from improved initial spruce establishment. Once established, seedling survival was not affected by burning. Ground cover on burned and unburned areas are compared.

730. ______
1966. A test of pruning Sitka spruce in Alaska. Northern Forest Exp. Sta. USDA Forest Serv. Res. Note NOR-13, 3 pp., illus.

Describes a test of dead-limb pruning of 38-year-old trees. Clear wood production over smooth branch cuts began 5 to 12 years after pruning. Decay associated with pruning was not a problem.

731. ______
1967. Natural reforestation on a mile-square clearcut in southeast Alaska. Pacific Northwest Forest & Range Exp. Sta. USDA Forest Serv. Res. Pap. PNW-52, 16 pp., illus.

Natural reforestation on a 700-acre logging unit of the Maybeso Experimental Forest, Prince of Wales Island, Alaska, was studied during 9 years beginning with clearcutting of the old-growth western hemlock-Sitka spruce stand. Production and dissemination of seed and establishment, development, and species composition of tree reproduction are discussed.

732. Harris, Arland S.
1965. Subalpine fir on Harris ridge near Hollis, Prince of Wales Island, Alaska. Northwest Sci. 39(4): 123-128, illus.

Sitka spruce, mountain hemlock, and subalpine fir were found in scattered clumps at 3,000-foot elevation.

733. Hartmann, F. K., Querengasser, F., and Jahn, G.
1953. Unterlagen fur den Anbau westamerikanischer Nadelholzarten in Deutschland. [Basic data for the planting of western North American coniferous species in Germany.] Allg. Forst- und Jagdzeit. 125(1): 25-48. [In German.]

734. Hasan, S. M.
1953. Heart rot in trees with special reference to the development of butt rot in Sitka spruce. Pakistan J. Forest. 3(4): 178-185, illus.

Describes and discusses the results of an investigation of 25 trees, 40 years old, growing in Britain on a shallow soil with badly drained subsoil.

735. Hathway, D. E.
1960. Researches on the tannin content of the stembark of Sitka spruce and Douglas-fir. *In* Report on forest research for the year ended March 1959. Great Brit. Forest. Comm., pp. 115-116. London: H. M. Stationery Office.

Tannin content from bark of 27-year-old trees was not affected by the time harvested, but the red color of winter-harvested bark was more pronounced than from bark peeled during the growing season. After trees were cut, the amount of available tannin decreased with time. Therefore, bark should be peeled and dried within a month of felling.

736. _______
1961. Utilisation of tan barks: extraction of Sitka spruce bark. *In* Report on forest research for the year ended March 1960. Great Brit. Forest. Comm., pp. 107-108. London: H. M. Stationery Office.

Chemicals extracted from bark gave a usable product. N:N-dimethylformamide (IMF) and methanol both appear to be suitable agents for extracting spruce bark.

737. Hawkes, Carl.
1953. Planes release tree plantation. J. Forest. 51: 345-348, illus.

738. Hawley, Ralph C.
1936. Professional honesty as regards selective logging. J. Forest. 34: 136-138.

739. _______
1954. The practice of silviculture. Ed. 6, 525 pp., illus. New York: John Wiley & Sons.

740. Hayes, A. J.
1965. Studies on the decomposition of coniferous leaf litter. I. Physical and chemical changes. J. Soil Sci. 16(1): 121-140, illus.

Describes decomposition rate as measured by loss in dry weight, comparing *Picea*, *Pinus*, and *Abies* litter. Changes in nitrogen, carbon to nitrogen ratio, and extractable polyphenols are discussed.

741. _______
1965. Studies on the decomposition of coniferous leaf litter. II. Changes in external features and succession of microfungi. J. Soil Sci. 16(2): 242-257, illus.

Describes the colonization of litter by various fungal mycelia and accompanying changes in external appearance of litter.

742. _______
1965. Studies on the distribution of some phthiracarid mites (Acari: Oribatidae) in a coniferous forest soil. Pedobiologia, Jena 5(3): 252-261, illus.

743. Haygreen, J. G.
1963. Some reasons for variability in the shrinkage of green lumber. Univ. Minn. Sch. Forest. Forest Note 140, 2 pp.

The fiber saturation point of Sitka spruce was found to be 28 percent.

744. Hays, Henry E.
1960. Status of regeneration on areas logged on the South Tongass since 1954. (Abstr.) Eleventh Alaska Sci. Conf. Proc.: 146.

745. Hazard, John W.
1965. Timber resource statistics for southwest Washington. Pacific

Northwest Forest & Range Exp. Sta. USDA Forest Serv. Resource Bull. PNW-15, 32 pp.

746. _______ and Metcalf, Melvin E.
1964. Forest statistics for southwest Oregon. Pacific Northwest Forest & Range Exp. Sta. USDA Forest Serv. Resource Bull. PNW-8, 32 pp.

747. _______ and Metcalf, Melvin E.
1965. Forest statistics for west-central Oregon. Pacific Northwest Forest & Range Exp. Sta. USDA Forest Serv. Resource Bull. PNW-10, 35 pp.

748. Heaman, J. C.
1967. Plus tree register for hemlock and other species. Brit. Columbia Forest Serv. Forest Res. Rev. 1967: 42.

Sitka spruce plus tree records and all material available in the British Columbia Forest Service clone bank collected as part of experimental project 587 have been turned over to the Tree Improvement Board for the use of board members. Grafting techniques used for spruce were not satisfactory, and propagation by rooting appears preferable.

749. Hearmon, R. F. S.
1958. The influence of shear and rotatory inertia on the free flexural vibration of wooden beams. Brit. J. Appl. Phys. 9: 381-388, illus.

Describes experiments in which the frequencies of wooden beams are measured up to the 16th node, and a least-squares method is described for analyzing the results. Effects introduced by the anisotropic nature of wood are also investigated. (From author's summary.)

750. _______ and Barkas, W. W.
1941. The effect of grain direction on the Young's moduli and rigidity moduli of beech and Sitka spruce. Phys. Soc. Proc. 53: 674-680, illus.

751. _______ and Paton, J. M.
1958. The maximum moisture content of wood. Forestry 31: 53-62, illus.

The maximum moisture contents of 17 timbers including Sitka spruce were determined and compared with calculated values, assuming a density of 1.5 grams per cubic centimeter for the wood substance. The converse approach, in which the maximum moisture contents were used to determine basic densities, is also discussed.

752. Heath, G. W.
1966. The biology of forest soils. *In* Report on forest research for the year ended March 1965. Great Brit. Forest. Comm., pp. 103-106, illus. London: H. M. Stationery Office.

753. Hegnauer, R.
1962. Chemotaxonomie der Pflanzen. Eine Ubersicht uber die Verbreitiung und die systematische Bedeutung der Pflanzenstoffe. Band I. Thallophyten, Bryophyten, Pteridophyten und Gymnospermen. [Chemotaxonomy of plants. A survey of the distribution and

systematic significance of plant constituents. Thallophytes, Bryophytes, Pteridophytes and Gymnosperms.] Vol. I, 517 pp., illus. Basel and Stuttgart: Birkhauser Verlag. [In German.]

754. Heintzleman, B. F.
1923. The standing timber resources of Alaska. West Coast Lumberman 44(518): 102-103, 108, illus.

755. _______
1928. Pulp timber resources of southeastern Alaska. U.S. Dep. Agr. Misc. Pub. 41, 34 pp., illus.

Describes Sitka spruce in Alaska. The largest tree known is reported to be 14-1/2 feet in diameter at a point 6 feet above ground.

756. _______
1934. A plan for the management of brown bear in relation to other resources on Admiralty Island, Alaska. U.S. Dep. Agr. Misc. Pub. 195, 20 pp., illus.

The commercial forest stands on Admiralty Island are composed of about 80 percent western hemlock and 20 percent Sitka spruce. A few trees of Alaska-cedar are scattered through the commercial forests. Commercial forest land is estimated at 460,000 acres. Management of wildlife in relation to timber is discussed.

757. Heintzleman, B. Frank.
1949. Forest of Alaska. U.S. Dep. Agr. Yearbook 1949: 361-372, illus.

758. Heit, C. E.
1950. Physiology of germination. N.Y. State Agr. Exp. Sta. Rep. 1949: 42-43.

Seven species of spruce were studied. Sitka spruce did not germinate promptly and completely at temperatures of 20° C. or below. The smaller seeded spruce species were found to be sensitive to moisture during germination.

759. _______
1961. Laboratory germination and recommended testing methods for 16 spruce *Picea* species. Offic. Seed Anal. Ass. Proc. 51: 165-171, illus.

Summarizes research and experience on germination, and presents recommendations for 10 American and six exotic spruces, including Sitka spruce.

760. Heller, E.
1910. Partial list of plants, chiefly shrubs and trees. *In* Mammals of the 1908 Alexander Alaska Expedition. Univ. Calif. Zool. Pub. 5: 349-360, illus.

761. Helmers, A. E.
1960. Alaska forestry - a research frontier. J. Forest. 58: 465-471, illus.

Describes briefly research done and needed in Alaskan forests including silviculture, management, insects, disease, fire, products utilization, marketing, and wildlife research. Sitka spruce comprises about 30 percent of the timber volume in southeast Alaska.

762. Henman, D. W.
1961. Pruning of conifers by disbudding. *In* Report on forest research for the year ended March 1960. Great Brit. Forest. Comm., pp. 166-172. London: H. M. Stationery Office.

Hand disbudding as a means of producing knot-free timber has been unsuccessful with Sitka spruce.

763. ________
1963. Some effects of isolating selected plantation trees for the first sixteen to twenty-three years after planting. *In* Report on forest research for the year ended March 1962. Great Brit. Forest. Comm., pp. 145-156, illus. London: H. M. Stationery Office.

Describes the effect of drastic thinning on Sitka spruce, Norway spruce, and Douglas-fir. Within a plantation spaced 4-1/2 by 6 feet, some vigorous trees were completely freed from competition of surrounding trees. Some crop trees were pruned.

764. ________
1963. Pruning conifers for the production of quality timber. Great Brit. Forest. Comm. Bull. 35, 55 pp., illus.

Describes the results of experimental pruning of Sitka spruce and other conifers begun by the Forestry Commission in 1931. An appraisal is included of the aims of pruning, and the experimental results are used to make provisional recommendations for forest practice.

765. ________
1965. Effects of thinning and spacing. *In* Report on forest research for the year ended March 1964. Great Brit. Forest. Comm., p. 36. London: H. M. Stationery Office.

766. ________
1965. Growth fall-off in spruce crops. *In* Report on forest research for the year ended March 1964. Great Brit. Forest. Comm., pp. 38-39. London: H. M. Stationery Office.

767. ________
1965. Some early responses to increased intensity of heathland cultivation. *In* Report on forest research for the year ended March 1964. Great Brit. Forest. Comm., pp. 158-165. London: H. M. Stationery Office.

768. ________
1966. Seed trapping: Sitka spruce. *In* Report on forest research for the year ended March 1965. Great Brit. Forest. Comm., p. 31. London: H. M. Stationery Office.

Seed fall in a 38-year-old Sitka spruce stand began before October and continued through March. Total seed production was 1-1/4 million viable seeds per acre, although 70 percent of the trees in the stand bore no cones.

769. Hennig, Rolf.
1954. Die tierischen und pflanzlichen Schädlinge unserer wichtigsten fremdländischen Holzarten. [Animal and plant pests of our most important exotic species.] Z. Pflanzenkrankh. 61(5): 255-269. [In German. English summary.]

Mainly a review of German literature. Sitka spruce is among the species discussed.

770. Henriksen, H. A.
1951. Et udhugningsforsog I Sitkagran. [A thinning experiment in Sitka spruce.] Forstl. Forsøgsv. Danmark 20(5): 403-418, illus. [In Danish.]

Thinning experiments were begun in 1935 on spruce planted on dunes between 1905 and 1912. Results for four thinning grades are tabulated, showing the number of stems, average height and diameter, basal area, and volume; the annual volume and basal area increment at 2-year intervals over 16 years; the 1951 volume per hectare by diameter classes; and average stem form in 1951. An attack by *Hylesinus micans* in 1949-51 appeared to be related to the degree of thinning--most severe in the heavily thinned plots and slight in the unthinned or lightly thinned plots.

771. _______
1955. Undersøgelser over Sitkagranens vaekst sundhed og stabilitet i Vilsbol og Nystrup plantager. [Growth, health, and stability of Sitka spruce in Vilsbol and Nystrup plantations.] Dansk Skovforenings Fro̊udualg, pp. 33-40, illus. [In Danish.]

772. _______
1956. Sitka-Fichte und Douglasie in der dänischen Forstwirtschaft. [Sitka spruce and Douglas-fir in Danish forestry.] Allg. Forstzeitschrift 45/46: 581-583, illus. [In German.]

773. _______
1958. Sitkagranens vaest og sundhedstilstand i Danmark. [The increment and health of Sitka spruce in Denmark.] Forstl. Forsøgsv. Danmark 24(1): 371. [In Danish. English summary.]

774. _______
1961. A thinning experiment with Sitka spruce in Nystrup dune forest. Forstl. Forsøgsv. Danmark 27(2): 175-232.

775. _______ and Jorgensen, E.
1954. *Fomes annosus* attack in relation to grade of thinning. Eleventh IUFRO Congress Proc.(Rome) 1953, Part 2, Sect. 24, pp. 663-667.

776. _______ and Jørgensen, Erik.
1953. Rodfordaerangreb I relation til udhugningsgrad. [*Fomes annosus* attack in relation to grade of thinning.] Forstl. Forsøgsv. Danmark 21(2): 215-251. [In Danish. English summary.]

777. Henry, A.
1917. Large Sitka spruces in Scotland. Quart. J. Forest. 11: 65-66.

778. Henry, Joseph Kaye.
1915. Flora of southern British Columbia and Vancouver Island: with many references to Alaska and northern species. 363 pp. Toronto: W. J. Gage & Co.

779. Hergert, H. L., and Goldschmid, Otto.
1958. Biogenesis of heartwood and bark constitutents. J. Organ. Chem. 23(5): 700-704, illus.

780. Herman, Francis R.
1964. Epicormic branching of Sitka spruce. Pacific Northwest Forest & Range Exp. Sta. USDA Forest Serv. Res. Pap. PNW-18, 9 pp., illus.

Presents the effects of thinning and road right-of-way cutting on origin and development of epicormic branches on Sitka spruce. Light thinnings did not cause significant increases in growth of epicormic sprouts. Stems bordering right-of-way cuttings had an abundance of vigorous sprouts. Suggests that moderate to heavy thinning will stimulate epicormic branching, but such sprouting should have little influence upon quality of pulpwood and structural lumber. (Author's summary.)

781. Hesmer, H., and Gunther, K. H.
1962. Auswirkungen des Trockenjahres 1959 in den wäldern Nordrhein-Westfalens. [Effects of the drought year of 1959 in the forest of North Rhine-Westphalia.] Forstarchiv 33(6): 113-125, illus. [In German.]

782. Hetherington, J. C.
1964. Brush control in coastal British Columbia. Brit. Columbia Forest Serv. Res. Note 38, 56 pp., illus.

Sitka spruce has a shade tolerance almost equal to grand fir but is unlikely to survive for long under heavy shade. It has had limited success when planted under salmonberry and other brush species. Methods of brush control are described.

783. _______
1967. *Picea sitchensis*. Crown diameter: stem diameter relationships in managed stands of Sitka spruce. Commonwealth Forest. Rev. 46(4): 278-281 plus 1 graph, 2 tables.

Straight line regression equations for the prediction of crown diameter from stem diameter are developed for a range of yield classes. The amount of variation in crown diameter accounted for was not significantly increased by the inclusion of tree height in the regression equation for all the data combined. The results are briefly discussed in the light of previous work. (Author's summary.)

784. _______ and Page, G.
1965. Forest site evaluation with particular reference to soil and physiographic factors. Welsh Soils Discuss. Group Nat. Agr. Adv. Serv. Rep. (Aberystwyth) 6: 58-69.

785. Heusser, C. J.
1953. Radiocarbon dating of the thermal maximum in southeastern Alaska. Ecology 34: 637-640, illus.

786. ________
1954. Alpine fir at Taku Glacier, Alaska, with notes on its postglacial migration to the Territory. Torrey Bot. Club Bull. 81(1): 83-86, illus.

Isolated Sitka spruce occur at almost 4,000-foot elevation on nunataks in the Juneau Ice Field, 8 miles from timberline.

787. Heusser, Calvin J.
1952. Pollen profiles from southeastern Alaska. Ecol. Monogr. 22(4): 331-352, illus.

788. ________
1954. Nunatak flora of the Juneau Ice Field, Alaska. Torrey Bot. Club. Bull. 81(3): 236-250, illus.

Decumbent individuals of Sitka spruce were found on four widely separated nunataks at the 3,500-3,900-foot elevation.

789. ________
1954. Additional pollen profiles from southeastern Alaska. Amer. J. Sci. 252: 106-119, illus.

790. ________
1955. Pollen profiles from the Queen Charlotte Islands, British Columbia. Can. J. Bot. 33: 429-449, illus.

791. ________
1955. Pollen profiles from Prince William Sound and southeastern Kenai Peninsula, Alaska. Ecology 36(2): 185-202.

792. ________
1960. Late-Pleistocene environments of north Pacific North America. Amer. Geogr. Soc. Spec. Pub. 35, 308 pp., illus.

Describes the distribution, habitat, and plant associates of Sitka spruce throughout its range. Sitka spruce became luxuriant from southeastern Alaska to Oregon during the Late Postglacial. It was a Late-Postglacial migrant along the ocean coast of the Kenai Peninsula and on Afognak and Kodiak Islands.

793. ________
1964. Palynology of four bog sections from the western Olympic Peninsula, Washington. Ecology 45: 23-40, illus.

794. ________
1965. A Pleistocene phytogeographical sketch of the Pacific Northwest and Alaska, pp. 469-483, illus. *In* The quaternary of the United States. H. E. Wright, Jr., and David G. Frey [eds.]. Princeton, N. J.: Univ. Press.

Discusses the migrations of Sitka spruce and its associates from middle Wisconsin times to the present. Late-Glacial vegetation in the Pacific Northwest was mostly lodgepole pine park land, which along the moist coastal strip was succeeded by Sitka spruce and then Sitka spruce-western hemlock. Like the area south of glacier boundaries in Washington, unglaciated coastal refugia may have served as centers for plant invasion of deglaciated terrain. Unglaciated interior Alaska also was an extensive refugium for the major forest trees.

795. Higgins, Norman C.
1957. The equilibrium-moisture-content/relative-humidity relationships of selected native and foreign woods. Forest Prod. J. 7: 371-377, illus.

Data on equilibrium moisture content at relative humidity between 21 and 93 percent, on fiber saturation points, volumetric shrinkage, specific gravity, and hysteresis are presented and discussed for Sitka spruce and 11 other woods. Methods of measuring humidities over saturated salt solutions are described.

796. Hiley, W. E.
1931. Improvement of woodlands. 250 pp., illus. London: Country Life, Ltd.

797. _______
1959. Two-storied high forest. Forestry 32(2): 113-116.

Douglas-fir's and Sitka spruce's annual rings might become too broad if the treatment described were applied, except at a rather advanced age. Nevertheless, the system has certain other advantages and, to attain these, it may be useful even if the annual rings become broader than optimum.

798. _______ and Cunliffe, N.
1923. Further observations of the relation of the height growth of trees to meteorological conditions. Ann. Appl. Biol. 10(3/4): 442-452, illus.

799. Hinson, W. H.
1961. Forest soils, long-term studies of the nutrient relations of forest crops and sites. *In* Report on forest research for the year ended March 1960. Great Brit. Forest. Comm., pp. 52-53. London: H. M. Stationery Office.

Tests of Sitka spruce needles from different parts of the same tree showed that nutrient status and needle weight are little affected by the position of the needles on the trees. Therefore, it should be possible to sample material from lower branches instead of from the top whorl (the normal sampling source) when access to the latter is difficult.

800. Hiorth, G.
1956. Allverdens traer i norsk jord. [Trees of the world on Norwegian soil.] 245 pp. S. Bern. Hegland-Flekkefjord: Tryktog Bundet Hos. [In Norwegian.]

Contains short notes on 500 kinds of conifers including Sitka spruce, and 1,500 broad-leaved trees and bushes; includes instructions for their culture.

801. ______
1956. Litt om produksjon av Sitkagranplanter. [Production of Sitka spruce seedlings.] Arsskr. norske Skogplantesk 1955: 89-95. [In Norwegian.]

802. Hodges, John D.
1967. Patterns of photosynthesis under natural environmental conditions. Ecology 48(2): 234-242, illus.

Net photosynthesis in six conifers including Sitka spruce was studied under various natural environmental conditions. Changes in the pattern of photosynthesis on clear days, especially the midday decrease, are apparently primarily controlled by changes in leaf water potential. In noble fir and Scots pine, water potential probably acts mainly through its influence on stomatal movement. In grand fir, Douglas-fir, hemlock, and Sitka spruce, however, some other mechanism, probably mesophyll resistance to CO_2 diffusion, seems to play a more important role. Both mechanisms probably operate concurrently in all species. Daily variations in leaf water potential seem to occur primarily in response to changes in atmospheric moisture or, more precisely, vapor pressure gradient from leaf to atmosphere. Variation in carbohydrate content, through its influence on solute concentration, may also influence leaf water potential. (From author's abstract.)

803. Hodges, John Deavours.
1965. Photosynthesis in forest tree seedlings of the Pacific Northwest under natural environmental conditions. 177 pp., illus. (Ph. D. thesis, Univ. Wash.) Ann Arbor: Univ. Microfilms.

A more detailed report than the preceding and following references.

804. ______
1965. Photosynthesis in forest tree seedlings of the Pacific Northwest under natural environmental conditions. (Abstr.) (Ph.D. thesis, Univ. Wash.) Diss. Abstr. 26(5): 2402.

805. Hoekstra, P. E., Merkel, E. P., and Powers, H. R., Jr.
1961. Production of seeds of forest trees. U.S. Dep. Agr. Yearbook 1961: 227-232.

The seedworm *Laspeyresia youngana* can infest as much as 79 percent of the cones on white spruce and Sitka spruce in Alaska.

806. Hoffman, B. E.
1913. Alaska woods, their present and prospective uses. Forest. Quart. 11(2): 185-200.

807. Hoffman, Bruce E.
1912. Sitka spruce of Alaska. Soc. Amer. Forest. Proc. 7(2): 226-238.

Describes silvics, range, occurrence, tolerance, seed, diseases and defects, uses, production, and management of Sitka spruce in Alaska.

808. _______ and Wakeman, W. J.
1937. The pulpwood resources of the lower Columbia River area. *In* the pulp and paper industry of the Pacific Northwest. Part II. U.S. Corps of Engineers, 81 pp., illus.

809. Holmes, G. D.
1950. The treatment of seed. *In* Report on forest research for the year ended March 1949. Great Brit. Forest. Comm., pp. 34-35. London: H. M. Stationery Office.

Tetrazolium bromide was selected as the most suitable staining compound tested both for the clarity of embryo staining and for nontoxicity. A standard viability test procedure has been developed, and a classification of stained embryos on the basis of the area stained and density of staining has been developed. Experiments over two seasons, using Sitka and Norway spruce, Scots pine, and European larch as test species, gave no evidence to support the practice of soaking seed before sowing, with the exception of Sitka spruce which showed an increase in final germination after soaking for 6 days (44 percent germination compared with 26 percent for unsoaked seed). Acid soaking had little effect on germination, and the final effect of acid treatment at the end of the first season was detrimental.

810. _______
1952. Forest tree seed investigations. *In* Report on forest research for the year ended March 1951. Great Brit. Forest. Comm., pp. 13-15. London: H. M. Stationery Office.

Four years' work on seed pretreatment by soaking was concluded and indicated that, for the species tested (Sitka and Norway spruces, Japanese larch, and Scots pine), soaking gave too little response to be worthwhile.

811. _______
1953. Chemical killing of trees to facilitate bark removal. *In* Report on forest research for the year ended March 1952. Great Brit. Forest. Comm., pp. 42-43. London: H. M. Stationery Office.

812. _______
1960. Supplementary report of the Forest Seeds Committee. Referee testing of *Picea sitchensis* and *Pseudotsuga taxifolia*. Twelfth Int. Seed Testing Ass. Conv. Proc., pp. 685-704. Oslo, Copenhagen: Frederiksberg Bogtrykker.

813. _______ and Buszewicz, G.
1954. Forest tree seed investigations, germination methods. *In* Report on forest research for the year ended March 1953. Great Brit. Forest. Comm., pp. 14-15. London: H. M. Stationery Office.

814. _______ and Buszewicz, G.
1955. Forest tree seed investigations. *In* Report on forest research for the year ended March 1954. Great Brit. Forest. Comm., pp. 1-4. London: H. M. Stationery Office.

815. _______ and Buszewicz, G.
1955. Experiments with cold-wet pretreatment as a method of increasing the germination rate of seed of Douglas-fir, Sitka spruce, and

lodgepole pine. *In* Report on forest research for the year ended March 1954. Great Brit. Forest. Comm., pp. 84-91. London: H. M. Stationery Office.

Soaking Sitka spruce seed in water or on wet blotting paper for 21 days at 36° F. increased germination rate.

816. _______ and Buszewicz, G.
1959. Forest tree seed investigations. *In* Report on forest research for the year ended March 1958. Great Brit. Forest. Comm., pp. 17-20. London: H. M. Stationery Office.

Sitka spruce seed stored 4 years at 2° C. showed negligible loss in viability.

817. _______ and Buszewicz, G.
1960. Forest tree seed investigations. *In* Report on forest research for the year ended 1959. Great Brit. Forest. Comm., pp. 15-18. London: H. M. Stationery Office.

818. _______ and Cousins, D. A.
1960. Application of fertilizers to checked plantations. Forestry 33(1): 54-73, illus.

In April 1959, the first large-scale aerial fertilizer application was done in Britain following 8 years of study at Wilsey Down forest, Cornwall, and Halwill forest, Devon. The paper reviews site problems and experimental results at Wilsey Down, with an account of the large-scale fertilizer-spreading operations.

819. _______ and Faulkner, R.
1952. Experimental work in nurseries. *In* Report on forest research for the year ended March 1951. Great Brit. Forest. Comm., pp. 15-26. London: H. M. Stationery Office.

820. _______ and Faulkner, R.
1953. Experimental work in nurseries. *In* Report on forest research for the year ended March 1952. Great Brit. Forest. Comm., pp. 15-27. London: H. M. Stationery Office.

821. _______ and Faulkner, R.
1955. Experimental work in nurseries. *In* Report on forest research for the year ended March 1954. Great Brit. Forest. Comm., pp. 5-18. London: H. M. Stationery Office.

822. _______ and Ivens, G. W.
1952. Chemical control of weeds in forest nursery seedbeds. Great Brit. Forest. Comm. Forest Rec. 13, 31 pp., illus.

Describes experiments to evaluate chemicals for the control of annual weeds in first-year seedbeds of coniferous tree species including Sitka spruce.

823. Holms, John.
1967. Sitka spruce weevil in British Columbia. Can. Dep. Forest. &

Rural Develop. Forest Insect & Disease Surv., Forest Pest Leafl. June 1967, 3 pp. plus 9 figs.

824. Holmsgaard, E.
1955. Arringsanalyser af Danske skovtraeer. [Tree-ring analyses of Danish forest trees.] Forstl. Forsøgsv. Danmark 22(1): 1-246. [In Danish.]

825. Holmsgaard, Erik, and Kjaer, Arne.
1951. Undersøgelse over spiring I laboratorium og planteskole at 4 *Abies* - og 2 *Picea* - arter. [Research on germination in the laboratory and nursery of 4 *Abies* and 2 *Picea* species.] Dansk Skovforen. Tidsskr. 36(4): 203-226, illus. [In Danish.]

826. Holst, M. J.
1955. Breeding for weevil resistance in Norway spruce. Z. Forstgenetik 4(2): 33-37.

A promising approach to breeding weevil-resistant Norway spruce appears to be the hybridization of weevil-resistant white spruce with Norway spruce. Attempts at direct crosses have so far failed, but possibilities are now being explored for using Sitka spruce as a bridge for the transfer of genes for weevil-resistance from white to Norway spruce.

827. Holstener-Jorgensen, H.
1961. Undersøgelse af traearts- og aldersindflydelsen på grundvandstanden i skovtraebevoksninger på Bregentved. [The effect of various tree species and age of stand on the ground water level in stands at Bregentved.] Forstl. Forsøgsv Danmark 27(3): 233-480, illus. [In Danish. English summary.]

Measurements on water consumption by different stands suggest that for the same depth of rooting, consumption by beech and oak is similar and that by Norway and Sitka spruce considerably higher. The possibility of drainage on sites where the water table is high, especially in beech and spruce stands, is discussed.

828. Holubcik, Milan.
1960. Prispevok k otazke pestovania cudzokrajnych drevin v nasich porastoch. [Raising exotics in Czechoslovak stands.] Les. Cas. 6(1): 64-75, illus. [In Slovak.]

Discusses very briefly experience with 14 conifers including Sitka spruce.

829. Home, John Milne.
1945. Notes on growth of Sitka spruce. Scot. Forest. J. 59: 84-86.

Comparative data are given for two plantations of Sitka spruce in Argyll and Dumfriesshire. The first is 21 years old, planted with a spacing of 6 feet and heavily thinned; the second is 32 years old, planted with 4-foot spacing, and has been more lightly thinned.

830. Hopkins, David M.
1959. Some characteristics of the climate in forest and tundra regions in Alaska. Arctic 12(4): 214-220, illus.

831. Hopkinson, A. D.
1931. Notes on the Sitka spruce and other conifers on Queen Charlotte Islands. Forestry 5: 9-13.

A general description of the forests. Sitka spruce is the main commercial species and comprises 20 to 40 percent of the timber volume. Natural regeneration is abundant, rooting depth is variable depending on soil conditions, and little storm-wind damage is to be seen.

832. Horn, Stanley F.
1943. This fascinating lumber business. 328 pp., illus. New York: Bobbs-Merrill Co.

833. Howell, Thomas.
1903. A flora of Northwest America. Vol. I. Phanerogamae. 792 pp. Portland, Oreg.: Thomas Howell.

834. Hubert, Ernest E.
1931. An outline of forest pathology. 543 pp., illus. New York: John Wiley & Sons.

835. Hudson, Winifred M.
1960. The effect of initial bending on the strength of curved laminated timber beams. Wood 25(6): 234-236, illus.

836. ________
1961. The effect of precompression on the static and impact bending strength of wood. Wood 26(1): 18-20, illus.

Specimens of Douglas-fir, Sitka spruce, and noble fir were preloaded to induce compression stresses, and were then reversed and tested to destruction in static and impact bending. Results show that the reductions in strength in static bending were relatively small compared with those in strength under impact loading. Compression failures, which may not be significant under some conditions, must continue to be of critical importance for the selection of material subjected to other than static loads. (From author's summary.)

837. Hulley, Clarence C.
1953. Alaska 1741-1953. 406 pp., illus. Portland, Oreg.: Binfords and Mort.

Sitka spruce planted in 1804 by the Russians at Dutch Harbor, Alaska, have maintained themselves but have not propagated.

838. Hulten, E.
1937. Outline of the history of arctic and boreal biota during the Quaternary period; their evolution during and after the Glacial period as indicated by the equiformal progressive areas of present plant species. 168 pp., illus. Stockholm: Bokforlags Aktiebolaget Thule.

839. Hulten, Eric.
1941. Flora of Alaska and Yukon I. Bot. Mus., Lunds Univ. Arsskr., N. F., Avd. 2, 37(1): 1-127, illus.

840. _______
1960. Flora of the Aleutian Islands, and westernmost Alaska peninsula with notes on the flora of Commander Islands. Ed. 2, 376 pp. plus 42 pp. maps and appendix and 38 plates. New York: Hafner Publ. Co.

Contains notes on Sitka spruce planted at Unalaska.

841. Hummel, F. C., and Brett, I.
1954. A simple method of estimating volume increment in stands of young conifers. Eleventh IUFRO Congress Proc. (Rome) 1953, Part 2, Sect. 25, pp. 794-798.

842. _______ and Christie, J.
1953. Revised tables (yield) for conifers in Great Britain. Great Brit. Forest. Comm. Forest Rec. 24, 23 pp., illus.

Gives yield tables and site curves for Scots pine, Corsican pine, Norway spruce, Sitka spruce, Japanese larch, European larch, and Douglas-fir; a revision of Great Brit. Forest. Comm. Bull. 10.

843. Hunt, George M., and Garratt, George A.
1967. Wood preservation. Ed. 3, 433 pp., illus. New York, St. Louis, etc.: McGraw-Hill Book Co.

844. Hunt, John, and Wright, Ernest.
1957. Needle-cast of Sitka spruce in Oregon. (Abstr.) Plant Dis. Rep. 41(7): 650.

845. Hunt, K., and Dutton, G. G. S.
1957. Sitka spruce hemicelluloses. (Abstr.) Chem. Can. 9(4): 62.

The hemicellulose contained d-xylose, l-arabinose, d-glucose, and d-glactose, as well as uronic acid components. Further extraction of the solid residue gave a hemicellulose which, on hydrolysis, yielded only d-glucose and d-mannose.

846. Hunt, Kenneth.
1957. The hemicelluloses of Sitka spruce. 48 pp. (M.S. thesis on file at Univ. Brit. Columbia.)

847. Huntington, LeRoy W.
1923. Forest aspects of Alaska. Univ. Wash. Forest Club Quart. 1(4): 15-26, illus.

848. Hussey, N. W.
1952. A contribution to the bionomics of the green spruce aphid (*Neomyzaphis abietina* Walker). Scot. Forest. 6(4): 121-130, illus.

Reports studies on Sitka spruce in Midlothian.

849. Husson, R., and Stauder, F.
1955. Lutte chimique contre le scolytide de l'epicea *Dendroctonus micans* Kug. [Chemical control of D. micans.] Rev. Forest. Franc. 7(7): 534-538. [In French.]

850. Hustich, Ilmari.
1952. The boreal limits of conifers. Arctic 6(2): 149-162.

851. Hutchinson, Ian.
1958. Some aspects of logging in the coast forest of British Columbia. J. Empire Forest. Rev. 37(1): 66-84, illus.

852. Hutchison, O. Keith.
1967. Alaska's forest resource. Pacific Northwest Forest & Range Exp. Sta. USDA Forest Serv. Resource Bull. PNW-19, 74 pp., illus., plus map.

Net volume of Sitka spruce sawtimber on commercial forest land in Alaska is estimated to be 54,198 million board feet. Net volume of growing stock is estimated to be 8,928,394,000 cubic feet. Tables give breakdowns by size, age, ownership, and grade. Forest conditions are described.

853. Hutchison, Robert.
1878. On the *Abies menziesii*, and its value for planting in Scotland, with detailed statistics of its progress in the country. Highland Agr. Soc. Trans. Ser. IV, 10: 174-185.

854. Hvass, Jens.
1950. Skyggeheuse og persienner til daekning af frobede. [Permanent high lath shades and lath screens for seedbeds.] Dansk Skovforen. Tidsskr. 35(5): 266-270, illus. [In Danish.]

855. Imperial Forestry Institute.
1959. Root disease of spruce on heavy soil. Imp. Forest. Inst. Rep. (Oxford) 1958-59: 14.

Decline in vigor in a 20-year-old Sitka spruce plantation on heavy clay soil was attributed to poor aeration leading to unsatisfactory root development. Pythium spp. were isolated from the soil, and experiments in inoculation of water cultures indicated that these species can cause a chronic disease that results in death of the finer roots and debility of the trees.

856. Institute of Forest Products.
1957. Conversion factors for Pacific Northwest forest products. Wash. State Dep. Conserv., Seattle, 28 pp.

Average weight of green Sitka spruce logs is 6,463 pounds per thousand board feet, Scribner scale. Weight per thousand board feet (nominal size air-dry, 12-percent moisture content) is 2,330 pounds; green weight per cubic foot is 38 pounds; air-dry (12-percent moisture) is 28 pounds. Values for other western conifers and softwoods are given. Many other conversion values, independent of species, are given.

857. Isaac, L. A.
1940. "Water sprouts" on Sitka spruce. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Res. Notes 31, pp. 6-7.

Examination of a 90-year-old stand showed that development of epicormic branches on Sitka spruce was clearly related to exposure of the trees to side light. Thrifty new limbs were found only on trees within 60 feet of the timber's edge, and mostly on those within 30 feet. Limbs alive but not thrifty were found on trees within 90 feet, whereas trees without epicormic branch formation were largely beyond 90 feet of the timber's edge.

858. _______
1940. Life of seed in the forest floor. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Res. Notes 31, p. 14.

Tests of seed storage in the duff showed that there was no germination after the first year for Sitka spruce.

859. _______ and Meagher, G. S.
1936. Natural reproduction on the Tillamook burn two years after the fire. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta., 19 pp., illus.

Discusses natural regeneration of several tree species, including Sitka spruce, following the Tillamook burn.

860. Isaac, Leo A.
1933. Reforestation by broadcast seeding in the spruce-hemlock type. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Res. Notes 11, p. 8.

861. _______
1939. Reforestation by broadcast seeding with small-seeded species. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Res. Notes 27, p. 9 plus 2 figs.

A study showed that a satisfactory stand of Sitka spruce can be obtained by broadcast seeding at the rate of 1 or 2 pounds of seed per acre if seeding is done within 2 years after a slash burn. The minimum amount of seed necessary is not known.

862. _______
1940. Vegetative succession following logging in the Douglas-fir region with special reference to fire. J. Forest. 38: 716-721.

863. _______
1960. Leo A. Isaac on silviculture. Six papers presented School of Forestry 1959. 32 pp., illus. Corvallis: Oreg. State Coll.

Sitka spruce is slightly more tolerant than Douglas-fir but less tolerant than western hemlock or western redcedar. It is a more prolific seeder than Douglas-fir and has a small seed (225,000 per pound). Limb shedding is variable and may be a genetic characteristic. Adventitious buds develop on boles after partial cuts or heavy thinning.

864. Isenberg, Irving H.
1951. Pulpwoods of United States and Canada. Ed. 2, 187 pp., illus. Appleton, Wis.: Inst. Pap. Chem.

865. Istratova, O. T.
1961. O khranenii pyl'tsy nekotorykh khvoinykh porod i ee proraśtanii. [Storage of pollen of some conifers, and its germination.] Glav. Bot Sada, Moskva Bjull., 43: 53-56. [In Russian.]

Experiments with pollen gathered on the Black Sea coast of Caucasia showed that pollen of Sitka spruce germinated best on 12-15 percent sucrose solution. When stored in desiccators, either at room temperatures of 16° to 27° C., or in a refrigerator at 3° to 4°, Sitka spruce pollen remained viable for 3 months and 6 months, respectively.

866. Jack, W. H.
1961. Comparison of actual production thinning yield plot, and yield table estimates. Forest. Northern Ireland 2(1): 6-15.

Yield, as determined from measurements of felled trees on two thinning plots, was compared with yield as estimated from Forestry Commission yield tables. The tables gave a reasonably good estimate regardless of thinning schedules. Thinning-plot data should be used with caution.

867. ______
1962. Assessing growth rates of a forest from thinning yield plots. Forest. Northern Ireland 3(1): 21-31.

868. ______
1964. The results of some trials using paraquat. Forest. Northern Ireland 5(1): 31-32.

869. ______
1964. Weedkilling in young forest plantations using paraquat. Seventh Brit. Weed Contr. Conf. Proc. 1: 263-266.

870. ______
1965. Experiments on tree growing on peat in northern Ireland. Forestry 38(1): 20-40, illus.

871. ______
1966. Variation in density of freshly felled Sitka spruce, and changes in density with time after felling. Agr. Res. Rec. (Belfast) 15(2): 51-66.

872. James, G. A.
1956. The rodent problem on cutover areas in southeast Alaska. USDA Forest Serv. Alaska Forest Res. Center Tech. Note 31, 2 pp.

Describes results of a rodent trapping study on timbered and cutover land in Sitka spruce-western hemlock type on Prince of Wales Island, southeast Alaska.

873. ______
1959. Seed production in a scrub stand. USDA Forest Serv. Alaska Forest Res. Center Tech. Note 43, 3 pp.

Reports a study in a scrub stand containing 73 percent western redcedar (by basal area), the remainder consisting of western hemlock and mountain hemlock with occasional Sitka spruce. Results showed a high seed production, especially for western redcedar. The total production by all species of 46 pounds per acre in a light-to-medium seed year compares with 91 pounds from a climax stand in a good year. Seedfall by species and date is tabulated.

874. James, George A., and Gregory, Robert A.
1959. Natural stocking of a mile-square clearcutting in southeast Alaska. USDA Forest Serv. Alaska Forest Res. Center Sta. Pap. 12, 9 pp., illus.

Describes seed dispersal and natural conifer regeneration on a 700-acre clearcutting. The stand harvested was old-growth timber consisting of 76 percent western hemlock, 20 percent Sitka spruce, and 2 percent each of western redcedar and Alaska-cedar. Although initial stocking was adequate, the authors favor continuing the present rule-of-thumb that no part of a cutting should be more than 20 chains from a seed source.

875. James, N. D. G.
1955. The foresters companion. 312 pp. Oxford: Basil Blackwell & Mott, Ltd.

876. Jayne, B. A.
1959. Indices of quality: vibrational properties of wood. Forest Prod. J. 9: 413-416.

Describes a method of nondestructive testing of wood based on electronic sensing of induced vibrations. Experiments with clean wood of Sitka spruce were encouraging enough to warrant detailed studies of other species.

877. _______
1960. Some mechanical properties of wood fibres in tension. Forest Prod. J. 10: 316-322, illus.

Describes and diagrams stress-strain properties of 10 wood species including Sitka spruce, based on tests of single wood fibers.

878. Jeffers, J. N. R.
1955. Relationship between the percentage of usable conifer seedlings and the mean height of seedlings as assessed at stocktaking. *In* Report on forest research for the year ended March 1954. Great Brit. Forest. Comm., pp. 101-106. London: H. M. Stationery Office.

879. _______
1959. Regression models of variation in specific gravity in four provenances of Sitka spruce. J. Inst. Wood Sci. 4, pp. 44-59, illus.

Describes statistical methods used to investigate the variation of nominal specific gravity in samples taken from four provenances of Sitka spruce.

880. _______
1966. Relationship between compressive strength, moisture content, rate of growth, and maximum bow in home-grown pitprops. Forestry 39(1): 100-114.

881. _______ and Howell, R. S.
1957. Use of a fractionally-replicated design in a pilot survey of moisture content and specific gravity of spruce and pine bark. *In* Report on forest research for the year ended March 1957. Great Brit. Forest. Comm., pp. 151-159. London: H. M. Stationery Office.

882. Jensen, Arne., Stephansen, Kari, and Løken, Asbjcrn.
1967. Stratifisering av frø fra *Picea abies* (L.) Karst. og *Picea sitchensis* (Bong.) Carr. En undersokelse av kjemiske forandringer i lopet av stratifisering. [Stratification of seed of *Picea abies* and *P. sitchensis*: a study of chemical changes during stratification.] Medd. Vestlandets Forstl. Forsøkssta. 43: 169-187, illus. [In Norwegian. English summary.]

Germinative energy of all Sitka spruce samples tested increased following stratification. In two samples the germinative capacity also increased. The chemical changes during stratification differ from those during seed ripening.

883. _______, Stephansen, Kari, and Løken, Asbjorn.
1967. Seed ripening of Norwegian coniferous trees. II. Variation in the chemical content and germination of seeds of *Picea abies* (L.) Karst. and *Picea sitchensis* (Bong.) Carr. Medd. Vestlandets Forstl. Forsøkssta. 44: 189-222, illus. [In English. Norwegian summary.]

Discusses and shows in graphic form the changes in germinative properties and chemical composition, at weekly intervals, of seeds of *P. abies* (three trees) and *P. sitchensis* (one tree).

884. Jensen, C. F.
1952. Orkanen den 11 Februar 1952. [The hurricane of 11 February 1952.] Dansk Skovfor. Tidsskr. 37(5): 290-298, illus. [In Danish.]

Sound Norway and Sitka spruce were about as windfirm as *Abies alba*.

885. Jepson, Willis Linn.
1910. The silva of California. Calif. Univ. Mem. Vol. 2. 480 pp., illus. Berkeley: Univ. Press.

886. _______
1923. The trees of California. Ed. 2, 240 pp., illus. Berkeley: Ass. Stud. Store.

887. _______
1933. Phytogeography of the coniferae of western North America. Fifth Pacific Sci. Congr. Proc., pp. 3255-3264.

888. Jevtic, Jeremije.
1962. Uporedna ispitivanja prirasta i produkcije biomase omorike, smrče i Sitke u rasadnickim uslovima. [Comparative studies on the increment and biomass production of *Picea omorika*, *P. abies*, and *P. sitchensis* in nursery conditions.] Sumarstvo 15(3/4): 147-158. [In Serbian.]

At 3 and 5 years of age, Sitka spruce seedlings showed greatest height, biomass, and root-collar diameter. The root-shoot relationship was shown to depend on age and species as well as on nursery treatment.

889. Johnson, F. A.
1955. Volume tables for Pacific Northwest trees. (A compilation.) U.S. Dep. Agr. Handbook 92, 6 pp. plus 122 tables.

Gives volume tables (cubic feet and board feet) for 18 species of Pacific Northwest conifers, including Sitka spruce.

890. Johnson, Herman M.
1943. Recovery of aero quality lumber from Alaska spruce logs. Timberman 44(7): 56-57, 64.

An enterprise known as the Alaska Spruce Log Program was set up to produce aero quality logs. The first Davis raft was delivered at Anacortes, Wash., in January 1943. Quality of the Alaskan logs is described and compared with those from Oregon. Alaskan logs averaged 1 to 9 inches smaller in diameter, had 5 percent greater defect, and off-center heart was present in one-third of the logs. The off-center condition was seldom present in Oregon logs.

891. Johnson, Hugh, and Jorgenson, Harold T.
1963. The land resources of Alaska. 551 pp. New York: Univ. Publ.

892. Johnson, L. P. V.
1939. A descriptive list of natural and artificial interspecific hybrids in North American forest-tree genera. Can. J. Res. 17(12): 411-444.

Contains table showing interspecific crosses of *Picea sitchensis* Carr. with *P. canadensis* B.S.P., and *P. engelmanni* Engelm., with country, author, and date of report or of origin.

893. Johnson, Norman E.
1965. Distribution of Sitka spruce weevil eggs on leaders of open-grown Sitka spruce in southwest Washington. Weyerhaeuser Forest. Pap. 3, 11 pp., illus.

The Sitka spruce weevil (*Pissodes sitchensis* Hopk.) was found to start oviposition near the tip of the leader of Sitka spruce. As the season progressed, the weevil moved farther down the terminal, ovipositing with decreasing frequency until reaching the node. Most eggs were laid on the side of the terminal away from the afternoon sun. (From author's summary.)

894. _______
1965. A test of 12 insecticides for the control of the Sitka spruce weevil, *Pissodes sitchensis* Hopkins. J. Econ. Entomol. 58: 572-574.

Twelve insecticides are listed in increasing order of effectiveness, with respect to untreated control.

895. _______ and Zingg, John G.
1966. A test of several systemic insecticides for postoviposition control of the Sitka spruce weevil (*Pissodes sitchensis*). J. Econ. Entomol. 59: 765-766.

Oxydemetonmethyl, Bidrin, and probably Azodrin, would appear to be effective if applied in May. Concentration should be about 1 percent and the spruce leaders should be thoroughly wetted.

896. Johnson, R. P. A., and Gibbons, W. H.
1929. Properties of western hemlock and their relation to uses of the wood. U.S. Dep. Agr. Tech. Bull. 139, 62 pp., illus.

897. Johnston, D. D., and Pratt, G. H.
1962. The air-seasoning of Sitka spruce in Scotland. Scot. Forest. 16(3): 148-156, illus.

An investigation was made into the rates at which sawn Sitka spruce could be air-dried at Strachur, Argyllshire, where the annual rainfall averages about 90 inches and at Culloden, near Inverness, where it is only about 29 inches.

898. Johnston, D. R.
1954. Structure drawings to "specimen woods" sheet 40: Muputu, mjombo, Sitka spruce, Morabukea. Wood 19(10/12): 410.

899. _______ and Bradley, R. T.
1963. Forest management tables. Great Brit. Commonwealth Forest Rev. 42(3): 217-227.

Introduces and explains the new Forestry Commission management tables currently in preparation.

900. Joly, R.
1961. Les causes animales dans le jaunissement et la chute des aiguilles de l'épicéa de Sitka (*Picea sitchensis*) et d'autres épicéas. [The animal causes of yellowing and needle-cast of *P. sitchensis* and other spruces.] Rev. Forest. Franc. 13(3): 179-186, illus. [In French.]

901. Jones, George Neville.
1936. A botanical survey of the Olympic Peninsula, Washington. Univ. Wash. Biol. Pub. 5, 286 pp., illus.

902. _______
1938. The flowering plants and ferns of Mount Rainier. Univ. Wash. Biol. Pub. 7, 192 pp. plus 9 plates.

903. Jones, LeRoy.
1962. Recommendations for successful storage of tree seed. Tree Planters' Notes 55: 9-20.

Recommends conditions for Sitka spruce as follows: moisture content, 4 to 6 percent; highest acceptable temperature, 33° to 38° F. Storage below 32° F. is preferable.

904. Jones, Nard.
1954. Ketchikan's "catch"--the new pulp mill. Amer. Forests 60(10): 12, 13, 38.

905. Jørgensen, C. A., Lund, A., and Treschow, C.
1939. Undersøgelser over rodfordaerveren, *Fomes annosus* (Fr.) Cke. [Studies on the heart-rot fungus, *Fomes annosus* (Fr.) Cke.] K. Veterinaer Højskole Aarsskr., pp. 71-129. [In Danish. English summary.]

Outlines the regional distribution of the fungus in Denmark. Among the conifers grown in that country, Sitka spruce is the most susceptible to the fungus.

906. Jørgensen, Erik.
1955. Trametesangreb i laehegn. [*Fomes annosus* infection in shelterbelts.] Dansk Skovforen. Tidsskr. 40(6): 279-285, illus. [In Danish. English summary.]

Infection in shelterbelts at three forest research stations, containing *Sorbus* spp., thorn, beech, and Sitka spruce, separately or in mixture, probably originated from softwood fence posts attacked by the fungus.

907. Jørgensen, M. Blangstrup.
1955. Traeer på Grønland. [Trees in Greenland.] Horticultura (Copenhagen) 9(2): 25-30, illus. [In Danish.]

908. Joyce, P. M.
1953. Comparison in yields of Sitka and Norway spruce (in Ireland). Irish Forest. 10(2): 67-68.

Measurement of 1/10-acre plots of 30-year-old Sitka and Norway spruce showed that mean annual increment of Sitka spruce was 72 percent greater than that of Norway spruce. Forestry Commission yield tables are quoted for comparison with results in Great Britain.

909. Junack, Gartow.
1961. Alte und neue Kulturmethoden der Kiefer und ihrer Mischholze in wirtschaftlicher Prufung. [Old and new methods of planting and sowing pine and species mixed with it considered economically.] Forsttech. Inform. (Mainz) (4): 25-30, illus. [In German.]

Describes labor and costs associated with shovel planting of Sitka spruce and other conifers without preparatory soil treatment in semishade of partly destroyed stands. The method was economical and highly successful.

910. Juttner, Otto.
1954. 70 Jahre Heideaufforstung. [Seventy years of heath afforestation.] Veroffentlichungen Akad. Raumforschung Landesplanung (Raumforschung Landesplanung Abhandl.) Bremen-Horn No. 27, 191 pp., illus. [In German.]

Sitka spruce is one of the species sometimes used successfully for heath afforestation in the coastal heaths of Germany from the Danish to the Dutch frontier.

911. Kangur, R.
1954. Shrews as tree seed eaters in the Douglas-fir region. Oregon State Board Forest. Res. Note 17, 23 pp., illus.

The study showed that shrews (*Sorex* spp.), though classed as insectivores, were eating great quantities of Douglas-fir seed (50 to 100 percent of seed in acceptance spots), and much Sitka spruce seed (15 to 50 percent), a species which is usually considered safe from seed-eating rodents.

912. Karlberg, Sten.
1961. Development and yield of Douglas-fir (*Pseudotsuga taxifolia* (Poir.) Britt.) and Sitka spruce (*Picea sitchensis* (Bong.) Carr.) in southern Scandinavia and on the Pacific coast. Skr. K. Skogshogsk. 34, 141 pp.

Presents data and yield tables for the two species, drawn mainly from Danish material, and compares their growth in Scandinavia and on the Pacific coast of North America.

913. Kausch, von Schmeling, W.
1962. Dürreschäden 1959 in den Kulturen der sandstandorte Schleswig-Holsteins. [Drought damage in 1959 in plantations on sandy sites in Schleswig-Holstein.] Forstarchiv 33(10): 211-213. [In German.]

A survey of plantations, including Sitka spruce, showed that all planting methods that reduced weed competition aided survival. Plants that suffered from late frosts were particularly susceptible to drought damage.

914. Kay, James.
1920. Notes on Jack pines and Sitka spruce. Roy. Scot. Arboricult. Soc. Trans. 34: 149-155 plus 2 plates.

915. ______
1922. The geographical range of Sitka spruce, western larch, and Douglas-fir. Roy. Scot. Arboricult. Soc. Trans. 36(2): 197-201.

916. Keen, F. P.
1952. Insect enemies of western forests. U.S. Dep. Agr. Misc. Pub. 273, 280 pp., illus.

Includes descriptions of insects affecting Sitka spruce, their life histories, and importance to management.

917. ______
1958. Cone and seed insects of western forest trees. U.S. Dep. Agr. Tech. Bull. 1169, 168 pp., illus.

The bulletin is arranged under tree, general, and species headings, with keys to seed and cone insects for each genus; and under insect pests, arranged systematically, with notes on life history, damage, hosts, distribution, etc. There is also a brief section on control. A list of species isolated from Sitka spruce cones is included; none are considered serious threats.

918. Kellog, R. S.
1910. The forest of Alaska. USDA Forest Serv. Bull. 81, 24 pp., illus.

919. Kelsey, Harlan P., and Dayton, William A.
1942. Standardized plant names. Ed. 2, 675 pp. Harrisburg, Pa.: J. Horace McFarland Co.

920. Kelso, William Cheatom.
1963. The effect of air blockage upon the permeability of wood to liquids. (Ph.D. thesis, Univ. Minn., 1962.) Diss. Abstr. 24(1): 12.

921. Kelso, W. C., Jr., Gertjejansen, R. O., and Hossfeld, R. L.
1963. The effect of air blockage upon the permeability of wood to liquids. Univ. Minn. Agr. Exp. Sta. Tech. Bull. 242, 40 pp., illus.

Experiments were made, using specimens of air-seasoned Sitka spruce heartwood and distilled water, to determine the conditions required for air to evolve from a liquid as it is forced through wood, thus causing bubbles and blocking the flow.

922. Kennedy, Elma I.
1965. Strength and related properties of woods grown in Canada. Dep. Forest. Forest Prod. Res. Br. Pub. 1104, 51 pp.

923. Kenwood, L. G.
1961. The influence of site quality on the height growth of some coniferous seedlings. 40 pp. (B.S. in Forestry thesis, on file at Univ. Brit. Columbia.)

Describes an attempt to measure the influence of site quality on growth of several tree species including Sitka spruce. Ninety-nine percent of the variation in average seasonal height growth on plots was attributable to their site indices.

924. Kimmey, James W.
1953. Survey in Alaska for forest-tree diseases, including cull in Sitka spruce and western hemlock. Fourth Alaska Sci. Conf. Proc. 1953: 110-112.

925. _______
1956. Cull factors for Sitka spruce, western hemlock, and western redcedar in southeast Alaska. USDA Forest Serv. Alaska Forest Res. Center Sta. Pap. 6, 31 pp., illus.

Fungi attacking Sitka spruce are listed as *Fomes pini*, *Armillaria mellea*, *Fomes annosus*, *Merulius sp.*, *Fomes nigrolimitatus*, *Fomes pinicola*, *Polyporus schweinitzii*, *Polyporous sulphureus*, *Trametes heteromorpha*, *Lentinus kauffmanii*. A method of estimating cull percent from surface indicators is given.

926. _______ and Stevenson, John A.
1957. A forest disease survey of Alaska. U.S. Dep. Agr. Res. Serv. Plant Dis. Rep. Suppl. 247: 87-98.

Lists 21 fungi collected on Sitka spruce. *Fomes pinicola* is the principal cause of heartrot in living Sitka spruce and causes most of the brown rot in western hemlock in Alaska. One of the principal means of entrance is through frost cracks in the bole of the trees. The prevalence of frost cracks increases in both spruce and hemlock toward the northern limit of their ranges.

927. Kindt, Svend.
1935. Sitkagran. [Sitka spruce.] Dansk Skovfor. Tidsskr. 10: 524-534, illus. [In Danish.]

928. ________
1956. En prøveflade i Sitkagran afsluttet. [Final results from a sample plot of Sitka spruce.] Dansk Skovfor. Tidsskr. 41(3): 147-149, illus. [In Danish.]

929. King, James E.
1958. Development of a stand of coniferous reproduction and interplanted Douglas-fir. Northwest Sci. 32(1): 1-8.

Stocking of an area with a sparse stand of young conifers, including Sitka spruce, was improved by interplanting with Douglas-fir, although animal damage and brush competition were serious obstacles to survival of planted trees. *Chermes cooleyii* had retarded or deformed 48 percent of the Sitka spruce in the natural stand.

930. Kinghorn, J. M.
1954. The influence of stand composition on the mortality of various conifers, caused by defoliation by the western hemlock looper on Vancouver Island, British Columbia. Forest. Chron. 30(4): 380-400.

In the first year after the collapse of the outbreak in 1946, tree mortality was light and only totally defoliated trees died. During the second and third years, mortality increased considerably, but by 1950 it had declined, surviving trees had recovered, and cumulative mortality up to 1950 was taken as the total suffered in the outbreak. Larger Sitka spruce trees suffered higher mortality for all defoliation classes than smaller trees, and mortality increased with percent of defoliation. Differences in mortality rates in crown, aspect, and altitudinal categories are explicable in terms of diameter or defoliation differences.

931. Kirk, Ruth.
1966. The Olympian rain forest. 86 pp., illus. Seattle: Univ. Wash. Press.

932. Klein, David R.
1965. Ecology of deer range in Alaska. Ecol. Monogr. 35(3): 259-284, illus.

In some areas on Coronation Island, new growth on spruce has been hedged by deer. This is most apparent adjacent to beaches at the heads of bays, although it also occurs where dwarfed spruce is available to deer at timberline. Spruce is rarely eaten by deer in southeast Alaska, and hedging of new growth has only been observed on small islands that have continued to support relatively high deer densities for many years.

933. Klein, J. A.
1951. Defect in the climax forests of southeast Alaska. USDA Forest Serv. Alaska Forest Res. Center Tech. Note 9, 1 p.

Sitka spruce is less defective on better sites. The largest trees on any site are the most defective. Percent cull due to visible defect is tabulated by species, diameter class, and site.

934. Kloft, W., and Ehrhardt, P.
1959. Untersuchungen über Saugtätigkeit und Schadwirkung der Sitkafichtenlaus *Liosomaphis abietina* (Walk.) (*Neomyzaphis abietina* Walk.). [Studies on the sucking activity and damage caused by *Neomyzaphis abietina*.] Phytopath. Z. 35(4): 401-410, illus. [In German. English summary.]

N. abietina was bred and studied on 5- to 6-year Sitka spruce under long-day conditions in the laboratory. Attack is through the stomata; the insect pierces the parenchyma and sucks the central phloem, producing honeydew. Seven amino acids were found in the saliva of adults. The mean time between the piercing of the needle and the appearance of chlorotic flecks was 5 to 6 days for larvae, 8 to 10 for adults. The uptake of P^{32} in these chlorotic spots was considerably below that of the healthy green parts of the needles. Respiration was increased and photosynthesis decreased in the damaged needles.

935. _______, Kunkel, H., and Ehrhardt, P.
1960. Beitrag zur Lachnidenfauna Mitteleuropas. [Notes on Central European lachnids.] Beitr. Entomol. 10(1/2): 161-168, illus. [In German. English summary.]

Includes a description of *Cinara pilicomis* on Sitka spruce with notes on its importance as a honeydew producer for bees and on ant trophobiosis.

936. _______, Ehrhardt, P., and Kunkel, H.
1961. Die Fichtenrohrenlaus *Elatobium abietinum* (Walk. 1849), ein endemisches Insekt der Rotfichte *Picea excelsa* in Europa. [*Neomyzaphis abietina* endemic on *P. abies* in Europe.] Waldhygiene 4(3/4): 121-125, illus. [In German.]

The aphid is endemic in Europe over the whole area of cultivation of Norway spruce, thought to be its natural host. Within the spruce's natural range, high densities (five to seven aphids per needle) have been found occasionally. Elsewhere, mass outbreaks have occurred only on exotics, particularly Sitka spruce, which is considered in danger from this pest over the whole area. In regions under Atlantic influence, mass outbreaks are further favored by anholocyclic hibernation.

937. Knudsen, H., and Gregersen, A.
1967. Forsøg med renholdelse og gødskning af nyplantede laetraeer, samt forskelling udtynding og gødskning af aldre traeer i laehegn. [Experiments with weeding and fertilizing of newly planted shelterbelts and varying thinning-out and fertilizing of old windbreak-trees.] Tidsskr. Planteavl 71: 231-245, illus. [In Danish. English summary.]

938. Kohlbrenner, P. J., and Schuerch, C.
1959. Benzene-alcohol soluble extractives of Sitka spruce. J. Organ. Chem. 24(2): 166-172, illus.

939. Kozlowski, T. T., Hughes, J. F., and Leyton, L.
1967. Movement of injected dyes in gymnosperm stems in relation to tracheid alignment. Forestry 40(2): 207-219, illus.

The path of upward movement of acid fuchsin dye was traced in pole-sized stems of Japanese larch, European larch, Lawson cypress, Sitka spruce, Norway spruce, and Scots pine.

940. Krajina, V. J.
1958-59. Ecological requirements of Douglas-fir, western hemlock, Sitka spruce, and western redcedar. Univ. Brit. Columbia, Dep. Biol. & Bot., 3 pp.

Describes a greenhouse experiment designed to obtain a better understanding of the ecological differences between the species listed in title. Author concludes that along the coast of the open Pacific Ocean, Sitka spruce, requiring great amounts of available magnesium, established pure stands under the influence of oceanic spray; therefore Sitka spruce grows well in alluvial soils rich in magnesium minerals and may even vegetate under the influence of brackish water rich in magnesium.

941. _______ (ed.)
1963. 1962 progress report National Research Council grant No. T-92. Ecology of the forests of the Pacific Northwest. Univ. Brit. Columbia, Dep. Biol. & Bot., 105 pp.

942. _______
1964. 1963 progress report National Research Council grant No. T-92. Ecology of the forests of the Pacific Northwest. Univ. Brit. Columbia, Dep. Biol. & Bot., 94 pp.

943. _______
1965. Ecology of western North America. Vol. 1. Univ. Brit. Columbia, Dep. Bot., 112 pp., illus.

Presents a collection of papers with emphasis on ecology of British Columbia and including coastal Sitka spruce.

944. _______
1965. 1964 progress report, National Research Council grant No. T-92. Ecology of the Pacific Northwest and of western Canadian arctic and subarctic. Univ. Brit. Columbia, Dep. Biol. & Bot., 18 pp.

945. _______
1965. 1965 progress report, National Research Council grant No. T-92. Ecology of the Pacific Northwest and of western Canadian arctic and subarctic. Univ. Brit. Columbia, Dep. Bot., 31 pp., illus.

Describes a preliminary survey of Sitka spruce communities on Vancouver Island. A 3-year project will be carried out to improve understanding of the structure and environmental relationships of different plant communities in habitats where Sitka spruce is the dominant tree.

946. _______
1966. 1966 progress report, National Research Council grant No. T-92. Ecology of the Pacific Northwest and of western Canadian arctic and subarctic. Univ. Brit. Columbia, Dep. Bot., 41 pp., illus.

947. Krajina, Vladimir J.
1959. Bioclimatic zones in British Columbia. Univ. Brit. Columbia Bot. Ser. 1, 47 pp., illus.

Classifies bioclimatic zones as characterized by vegetation types and including Sitka spruce forest.

948. _______ (ed.)
1965. Biogeoclimatic zones and classification of British Columbia. *In* Ecology of western North America. Vol. 1, pp. 1-17. Univ. Brit. Columbia, Dep. Bot.

949. Kramer, H.
1961. Die Verwendung der Oberhöhe in der Foresteinrichtung. [The use of top height in management.] Allg. Forst- und Jagdzeit. 132(5): 122-129, illus. [In German. English summary.]

950. _______
1966. Crown development in conifer stands in Scotland as influenced by initial spacing and subsequent thinning treatment. Forestry 39(1): 40-58, illus.

This paper deals with the different influences affecting the development of the crown percent in Norway spruce, Sitka spruce, and Douglas-fir stands and gives for these three species development curves of crown percent according to top height, thinning grade, and quality class. It shows the effect of different thinning grades on the crown surface (and crown volume) of the mean tree and the whole stand, together with the relationship between volume increment and crown surface (and volume). The contribution of the different canopy classes to the total increment of the stand is assessed. Finally the relevance which these findings might have on thinning techniques is considered. (Author's summary.)

951. Krause, Aurel.
1956. The Tlingit Indians. Results of a trip to the northwest coast of America and the Bering Straits. (Transl. Erna Gunther.) 310 pp., illus. Seattle: Univ. Wash. Press.

Describes spruce-hemlock forests of southeast Alaska and use of trees by the natives. Sitka spruce was used by the aboriginal Tlingit Indians for dugout canoes, hats, boxes; baskets were woven spruce root. The resin was used externally for treating sores, and heated seeds were used to cure toothache.

952. Krause, Robert L.
1954. Iron stain from metal fastenings may accelerate decay in some woods. J. Forest Prod. Res. Soc. 4(2): 103-111, illus.

953. Kreutzer, K.
1961. Wurzelbildung junger Waldbäume auf Pseudogleyböden. [Root formation by young forest trees on pseudogley soils.] Forstwiss. Central. 80(11/12): 356-392. [In German.]

Sitka spruce was not useful as an admixture in Norway spruce stands to improve root penetration into lower layers of pseudogley soils.

954. Krygier, James T., and Ruth, Robert H.
1961. Effect of herbicides on salmonberry and on Sitka spruce and western hemlock seedlings. Weeds 9(3): 416-422, illus.

The following foliage sprays showed promise for control of salmonberry (*Rubus spectabilis*): the propylene glycol butyl ether (PGBE) esters of 2, 4, 5-TP and 2, 4, 5-T; the butoxy ethanol formulations of the same herbicides; and solubilized acid and solubilized poly-glycol esters of 2, 4, 5-T. Amitrol also was effective, especially added to 2, 4-D, with or without 2, 4, 5-T. Most selective was the PGBE ester of 2, 4, 5-T (2 and 4 pounds per 100 gallons of water with 5-percent kerosene), which did not damage Sitka spruce and western hemlock seedlings. Amine formulations were ineffective on *R. spectabilis*, and damaged hemlock. 2, 4-D, 2-(2, 4-DP) and 2, 3, 6-TBA were unsatisfactory. (From author's summary.)

955. Kuchler, A. W.
1964. Potential natural vegetation of the conterminous United States. Amer. Geogr. Soc. Spec. Pub. 36, 116 pp., illus., plus map.

Consists of a large map of the United States showing major vegetation types, together with a manual describing the vegetation units. Each unit is described and illustrated, and a bibliography is included. Sitka spruce is shown to be a component of the spruce-cedar-hemlock forest, located along the coasts of Washington and Oregon, and occasionally on western slopes of the Cascade Range.

956. Kukachka, B. Francis.
1960. Identification of coniferous woods. Tappi 43: 887-896, illus.

Instructions are given here in the sequential use of primary diagnostic features in the identification of coniferous woods including Sitka spruce. A data chart or marginally perforated cards may be used. Microscopic features are necessarily emphasized because of the greater accuracy obtainable through their use.

957. Kumler, Marion Lawrence.
1963. Succession and certain adaptive features of plants native to the sand dunes of the Oregon coast. 149 pp., illus. (Ph.D. thesis on file at Oregon State Univ.)

958. Kuramoto, R. C.
1965. Plant associations and succession in the vegetation of the sand dunes of Long Beach, Vancouver Island. (M.S. thesis on file at Univ. Brit. Columbia.)

959. Lacassagne, Marcel.
1934. Etudes morphologique, anatomique, et systematique du genre *Picea*. [Studies in morphology, anatomy, and systematization of the genus *Picea*.] Trav. Lab. Forest. Toulouse, t. 2, vol. 3, art. 1, 292 pp.

Reports exhaustively on the genus *Picea* from the morphological and taxonomic standpoint, including a history of the genus, full description of each species, and identification key.

960. Ladefoged, Kjeld.
1938. Frostringsdannelser i vaarveddet hos unge Douglasgraner, Sitkagraner og laerketraeer. [Formation of frost rings in the spring wood of young Douglas-fir, Sitka spruce, and larch.] Forstl. Forsogsv. Danmark 102(15): 97-112 plus 12 figs. [In Danish.]

961. Lafond, Andre.
1962. Forest fertilization in Canada. Laval Univ. Forest Res. Found. (Quebec) Bull. 5, 46 pp., illus.

962. Laiho, Olavi.
1965. Further studies on the ectendotrophic mycorrhiza. Acta Forest. Fenn. 79(3): 1-35, illus.

Coniferous seedlings in nurseries and in forests in the United States, Puerto Rico, and in Europe were examined for presence of ectendotrophic mycorrhizae. Although *Picea sitchensis* roots bore only ectotrophic forms, some of these yielded pure cultures of the ectendotrophic fungal symbiont. Further, semiaseptic pure-culture mycorrhiza synthesis with this fungus and *P. sitchensis* produced ectotrophic mycorrhizae.

963. Laing, E. V.
1932. Studies on tree roots. Great Brit. Forest. Comm. Bull. 13, 73 pp. plus 17 plates.

Discusses types of mycorrhizae, their relationship to tree roots and to soil conditions, problems of establishment of Sitka spruce and other species on peat soils in Britain, as well as improvement of conditions for mycorrhizal formation through application of fertilizers.

964. ________
1947. Preliminary note on a disease of Sitka spruce in Cairnhill plantations, Durris, Kincardineshire (*Picea sitchensis* Carr.). Forestry 21(2): 217-220.

A disease on plantations was noted after brashing and pruning and has been found to be caused by *Nectria curcurbitula* Ft.

965. ________
1951. Botanical studies of variation in certain conifer species. *In* Report on forest research for the year ended March 1950. Great Brit. Forest. Comm., p. 124. London: H. M. Stationery Office.

966. Langner, W.
1959. Ergebnisse einiger Hybridierungsversuche zwischen *Picea sitchensis* (Bong.) Carr. und *Picea omorika* (Pancic) Purkyne. [Results of some trials of hybridization between *P. sitchensis* and *P. omorika*.] Silvae Genet. 8(5): 138-143, illus. [In German. English summary.]

Crosses, carried out in both directions, resulted in very few seeds, but these showed normal vitality. Hybrids from 1 year's trials exhibited hybrid vigor but those from other years did not. Hybrids were clearly intermediate between the parents in reaction to snow, to frost susceptibility, and to formation of leading shoot.

967. Larsen, C. Muhle.
1955. The seasonal variation in the natural rooting capacity of cuttings of Norway spruce and Sitka spruce. Z. Forstgenet. 4(3): 69-80, illus.

Reports on experiments made at the Royal Veterinary and Agricultural College's Arboretum, Horsholm, Denmark. Young twigs of the current year's growth were collected from lateral branches of Norway and Sitka spruce. Cuttings were taken in the period from the beginning of June to mid-April of the following year, propagated in cold frames, and examined the following autumn. Seasonal variations were noted in rooting ability, in the number and length of roots, and in the formation of new shoots. Seasonal variations are due largely to environmental growth conditions but also to length of cuttings. The only difficult period for rooting is at flushing, but the best time for taking cuttings under Danish conditions is early spring or the months of June and July, so that rooting can take place before winter.

968. Larsen, C. Syrach.
1937. The employment of species, types, and individuals in forestry. Veterinaer-og Landbohøjsk. Aarsskr., pp. 69-222 plus 7 plates.

969. ________
1943. Erfaringer med udenlandske traearter i Dansk skovbrug. [Experience with exotic tree species in Danish forestry.] Svenska Skogsvforen. Tidskr. 41: 166-199, illus. [In Danish.]

From the beginning of the nineteenth century up to the present time, the forested area of Denmark has increased from 4 percent to 8.2 percent of the total land area. This has been due largely to the planting of heathland and "kilt" (downs) with exotics. Sitka spruce has been used to a small extent.

970. Larsen, N. J.
1945. Sitkagran X Hvidgran. [Sitka spruce X white spruce.] Dansk Skovforen. Tidsskr. 30:450-451. [In Danish.]

The author reports that almost all the plants brought to his district as Sitka spruce and now in 7- to 12-year-old plantations are mainly Sitka X white spruce.

971. Latham, J.
1952. Timber for aeroplane construction--strength properties of Sitka spruce. *In* Selected government research reports, vol. 8, pp. 21-31, illus. London: H. M. Stationery Office.

Essential strength properties of Sitka spruce have been defined and an investigation made of possible direct application, based on 8,200 tests. The usefulness of brittleness tests has been evaluated, and recommendations are made. The question of design stresses is discussed.

972. ________
1952. Hair checks and imperfections in Sitka spruce laminae. *In* Selected government research reports, vol. 8, pp. 123-134, illus. London: H. M. Stationery Office.

Gives results of tests to determine the influence of hair checks on the strength of laminated Sitka spruce nose rib bends; to examine the effect of imperfections in sliced laminae; and to compare the relative merits of sliced and sawn laminae.

973. Laurent, T. H.
1966. Dwarfmistletoe on Sitka spruce--a new host record. Plant Dis. Rep. 50(12): 921.

A Sitka spruce infected by dwarf mistletoe (*Arceuthobium campylopodum* f. *tsugensis* (Rosendahl) Gill) was found on Chichagof Island, Alaska. The host, a 10-foot sapling, was in the understory of a western hemlock stand. Dwarf mistletoe infections were present on almost every hemlock in the stand. The specimen was associated with witches'-broom form, typical of infections found on western hemlock.

974. Lavers, Gwendoline M.
1966. The strength properties of timbers. Great Brit. Forest Prod. Res. Lab. Bull. 50, 32 pp., illus.

Describes equipment and methods used for testing woods and tabulates mechanical properties of many woods including Sitka spruce.

975. Law, Frank.
1957. The effect of afforestation upon the yield of water catchment areas. J. Inst. Water Eng. 11(3): 269-276.

In experiments from July 1955 to July 1956, a lysimeter was formed by building a concrete wall around part of a small, dense plantation of Sitka spruce at the Stocks Reservoir, Slaidburn, Yorkshire, and measurements were made of runoff, stemflow, and precipitation. Interception values ranged from 36 to 43 percent with little difference between winter and summer.

976. ________
1958. Measurement of rainfall, interception and evaporation losses in a plantation of Sitka spruce. Int. Ass. Hydrol. Eleventh Gen. Assembly Proc. (Toronto) 1957: 397-411, illus.

977. Lawrence, Donald B.
1958. Glaciers and vegetation in southeast Alaska. Amer. Sci. 46(2): 89-122, illus.

Traces vegetation development from the pioneer stage following ice recession through forest of spruce and hemlock to muskeg and pit pond formation.

978. Lawrence, William H., Kverno, Nelson B., and Hartwell, Harry D.
1961. Guide to wildlife feeding injuries on conifers in the Pacific Northwest. Western Forest. & Conserv. Ass., 44 pp., illus.

979. Leathart, P. S.
1967. A forestry tour in Iceland. Quart. J. Forest. 61(1): 5-24, illus.

980. Lejeune, R. R.
1962. A new B.C. reforestation problem. Brit. Columbia Lumberman 46(10): 30.

Damage to natural spruce regeneration on the Queen Charlotte Islands was caused by the weevil *Steremnius carinatus*, apparently native to the coastal forests.

981. Lembcke, G.
1961. Der Anbau von *Picea sitchensis* und *Pinus strobus* im Diluvialgebiet der Deutschen Demokratischen Republik und im Harz. [Growing *P. sitchensis* and *P. strobus* in the Diluvial region of E. Germany and in the Harz Mountains.] Tag. Deut. Akad. der Landwirtschaftswiss. (Berlin)26: 123-137, illus. [In German. English summary.]

Describes growth of about 50 Sitka spruce sample plots, mostly in the coastal region of Mecklenburg, and about 40 plots of *Pinus strobus*, mostly in the Lausitz region, aged mainly 20 to 60 years. Stem form was analyzed and volume tables were constructed. Height growth of Sitka spruce was best on sand and loam with a sufficiently high water table, and superior to Norway spruce. *Neomyzaphis abietina* attacked Sitka spruce but was not a serious problem.

982. Lemke, Paul Arenz.
1964. The genus *Aleurodiscus* (sensu stricto) in North America. Can. J. Bot. 42(2): 213-282.

983. LePont, P., and Pardé, J.
1962. Les resineux dans le nord de la Seine-Maritime. [Conifers in the north of Seine-Maritime.] Rev. Forest. Franc. 14(12): 979-993. [In French.]

Describes conifer plantations on clay-with-flints in the Dieppe region. Sitka spruce is the most successful species, with a mean annual increment of 16 to 18 cubic meters per hectare at 40 to 50 years; Douglas-fir does almost as well, and Japanese larch attains 13 cubic meters per hectare. Mean annual increment of the local climax beech forest is only 8 cubic meters per hectare.

984. Lesko, Gyorgy Laszlo.
1961. Ecological study of soils in the coastal western hemlock zone. 141 pp. (M.S. thesis on file at Univ. Brit. Columbia.)

Examinations of macroscopic soil properties and topographic position were used as a basis for delineation of forest associations in the coastal western hemlock zone, including Sitka spruce. The most important edaphic factors differentiating the forest association were moisture regime, soil depth, organic matter-N ratio, and K concentration.

985. Levisohn, I.
1963. Über Mykorrhizen und Pseudomykorrhizen. [About mycorrhizas and pseudomycorrhizas.] Mykorrhiza, Int. Mykorrhiza Symp. (Weimar) 1960: 27-34. [In German, English summary.]

Discusses pseudomycorrhizae of *Picea sitchensis*.

986. Levisohn, Ida.
1954. Aberrant root infections of pine and spruce seedlings. New Phytol. 53(2): 284-290 plus 5 photos.

In pine and spruce seedlings from forest nurseries in Great Britain, heavy root invasions by mycelia closely related to *Rhizoctonia sterilis* are frequently encountered. In spruce, they are characterized by the absence of a mantle and the presence of a very coarse intercellular net. In Sitka spruce, reduced vigor and growth caused by the aberrant infection is not pronounced.

987. _______

1956. Growth stimulation of forest tree seedlings by the activity of free-living mycorrhizal mycelia. Forestry 29(1): 53-59 plus 2 plates.

988. _______

1965. Mycorrhizal investigations. *In* Experiments on nutrition problems in forest nurseries, Blanche Benzian [ed.]. Great Brit. Forest. Comm. Bull. 37, 1: 228-235, illus.

Reports on mycorrhizal associations with Sitka spruce in forest nurseries in Great Britain as affected by fertilizer applications.

989. Lewinski, Von E. v.

1966. Möglichkeiten zur Mechanisierung bei der Aufforstung feuchter Grenzertragsböden--Ein Erfahrungsbericht. [Possibilities for mechanization in the afforestation of moist marginal lands: an empirical report.] Aus Walde 12: 57-66, illus. [In German.]

990. Leyton, L.

1950. The growth and mineral nutrient relations of trees growing on Calluna-dominated sites. Seventh Int. Bot. Congr. Pap. (Stockholm), pp. 251-252.

991. _______

1951. Nutrient uptake of conifers. *In* Report on forest research for the year ended March 1950. Great Brit. Forest. Comm., pp. 118-119. London: H. M. Stationery Office.

Describes experiments on the effect of pH on growth of Sitka spruce in water cultures.

992. _______

1951. Mineral nutrient studies in heathland plantations. *In* Report on forest research for the year ended March 1950. Great Brit. Forest. Comm., pp. 127-129. London: H. M. Stationery Office.

993. _______

1952. The effect of pH and form of nitrogen on the growth of Sitka spruce seedlings. Forestry 25(1): 32-40, illus.

The effect of pH and form of nitrogen (NH4 and NO3) on the growth of Sitka spruce seedlings has been investigated on nutrient culture solutions over the range of pH 3-7. In both nitrogen series, the reaction for optimum growth of both shoot and root appears to lie between pH 4 and 5. Above and below this range there is a decrease in dry-weight production accompanied by increasingly abnormal root development. The form of nitrogen supplied appeared to have little effect on total growth at equivalent reactions, but from the root/shoot ratios it seems that nitrate nitrogen stimulates a greater relative root production than does ammonia nitrogen. (From author's summary.)

994. _______
1953. Growth and nutrition in heathland plantations. *In* Report on forest research for the year ended March 1952. Great Brit. Forest. Comm., pp. 117-119. London: H. M. Stationery Office.

Significant changes in growth and nutrition of planted trees occurred due to removal of heather (screefing) and the application of ground mineral phosphates.

995. _______
1954. The growth and mineral nutrition of spruce and pine in heathland plantations. Imp. Forest. Inst. (Univ. Oxford) Pap. 31, 109 pp., illus.

Poor growth of Sitka spruce in young plantations on upland heaths is attributed to nitrogen deficiences in the soil, aggravated by heather vegetation. Temporary improvement in growth may be brought about either by application of nitrogenous fertilizer or by removal of the heather vegetation. On some sites, manganese also appears to play an important role in growth increases.

996. _______
1955. The influence of artificial shading of the ground vegetation on the nutrition and growth of Sitka spruce (*Picea sitchensis* Carr.) in a heathland plantation. Forestry 28(1): 1-6, illus.

A marked stimulus has been obtained by shading the heather vegetation surrounding trees, by means of wooden laths. The increased growth was accompanied by significant increases in the concentration of nitrogen, ash, and manganese in the needles, indicating a substantial increase in the availability of these nutrients to the trees. A similar shading experiment on plots from which the heather (*Calluna vulgaris* Hull) had been previously removed by screefing produced only doubtful responses. Heather plants growing beneath the laths were found to contain appreciably lower concentrations of nutrients in the foliage than unshaded plants. While the response of the trees to shading of the ground vegetation is attributed largely to reduced competition by the heather for available nutrients in the soil, especially nitrogen, the mulching effect of the heather in maintaining satisfactory moisture conditions during dry periods is also involved. These findings offer an explanation for the improvement in the growth of spruce in mixture with nurse trees when the latter form a closed canopy and suppress the ground vegetation. (Author's summary.)

997. _______
1957. The mineral nutrient requirements of forest trees. Ohio J. Sci. 57: 337-345.

Discusses forest tree nutrition using data on Sitka spruce to illustrate main points.

998. _______ and Weatherell, J.
1959. Coniferous litter amendments and the growth of Sitka spruce. Forestry 32(1): 7-13.

The growth of semichecked Sitka spruce on heathland has been stimulated to different degrees by the annual application (1956 and 1957) of litter of Scots pine, Corsican pine, lodgepole pine, Japanese larch, and Sitka spruce at rates corresponding to normal plantation conditions, following a heavier initial application (1955). Foliar analysis suggests that the response is at least partially attributable to the influence of the litters on the nitrogen nutrition of the spruce, and differences between litters appear determined by their nitrogen content. (From author's summary.)

999. Leyton, Leonard.
    1958. The relationship between the growth and mineral nutrition of conifers, pp. 323-345, illus. *In* The physiology of forest trees, Kenneth V. Thimann, William B. Critchfield, and Martin H. Zimmermann [ed.]. New York: The Ronald Press Co.

Discusses the value of foliar analysis as a reliable method for diagnosis of nutritional status. Author concludes that with proper sampling, foliar analysis provides a reasonable guide to particular mineral deficiences limiting tree growth and to interpretation of field observations. Information on needle composition generally provides little guidance to the degree of response to a given increase in nutrient supply because of complex interaction of many factors. Sitka spruce was one of the experimental species.

1000. Liang, C. Y., Bassett, K. H., McGinnes, E. A., and Marchessault, R. H.
    1960. Infrared spectra of crystalline polysaccharides. VII. Thin wood sections. Tappi 43: 1017-1024, illus.

The infrared spectra of wood sections have been recorded in the untreated state and after treatment for removal of lignin and hemicellulose. Differences between the spectra of hardwood (*Acer rubrum*) and softwood (*Pseudotsuga taxifolia, Tsuga heterophylla, Picea sitchensis, Thuja plicata*) sections were correlated with the greater glucomannan and smaller 4-0-methylglucuronoacetylxylan content of the latter. (From author's summary.)

1001. Liang, Ernest V.
    1927. Water content of seedlings and transplants in the nursery. Scot. Forest. J. 41: 26-35, illus.

1002. Liddicoet, A. R., and Righter, F. I.
    1960. Trees of the Eddy Arboretum. USDA Forest Serv. Pacific Southwest Forest & Range Exp. Sta. Misc. Pap. 43, 41 pp., illus.

1003. Lindquist, Bertil.
    1948. Genetics in Swedish forestry practice. 173 pp., illus. Stockholm: Svenska Skogsvårdsforeningens Forlag.

Strangulation by means of a thin iron wire wrapped several times around the stem has been shown to stimulate flowering of Sitka spruce to a high degree.

1004. Lindsay, A. D.
    1932. Sitka spruce. Commonwealth Forest. Timber Bur. (Canberra) Leafl. 24a, 8 pp.

Reviews the silvics of Sitka spruce in its natural range and outside its native habitats and concludes that it has value for plantations in Australia.

1005. Lines, R.
1953. The Scottish gale damage. Irish Forest. 10(1): 3-15.

1006. _______
1956. Provenance experiments. *In* Report on forest research for the year ended March 1955. Great Brit. Forest. Comm., pp. 35-36. London: H. M. Stationery Office.

Gives notes on provenance trials of lodgepole pine, Sitka spruce, and Douglas-fir. A vivid yellow and purple discoloration was noted on some Sitka spruce, but the cause has not been discovered.

1007. _______
1964. Early experiments on the provenance of Sitka spruce. *In* Report on forest research for the year ended March 1963. Great Brit. Forest. Comm., pp. 136-146. London: H. M. Stationery Office.

Describes results of many provenance tests in Europe and Britain with Sitka spruce from throughout the tree's natural range.

1008. _______ and Aldhous, J. R.
1961. Provenance studies: Sitka spruce. *In* Report on forest research for the year ended March 1960. Great Brit. Forest. Comm., pp. 43-44. London: H. M. Stationery Office.

Describes early growth of 12 provenances ranging from Hollis, Alaska, to southern Oregon. Differences in height growth and phenology are mentioned. Seven planting sites have been chosen in the most important parts of the Sitka spruce range in Britain.

1009. _______ and Mitchell, A. F.
1965. Provenance: Sitka spruce. *In* Report on forest research for the year ended March 1964. Great Brit. Forest. Comm., pp. 31-32. London: H. M. Stationery Office.

Describes trials of Sitka spruce from Alaska, British Columbia, Washington, and Oregon.

1010. _______ and Mitchell, A. F.
1966. Provenance: Sitka spruce. *In* Report on forest research for the year ended March 1965. Great Brit. Forest. Comm., pp. 38-43. London: H. M. Stationery Office.

Includes report on a provenance experiment with Sitka spruce planted in 1960-61. Seed sources ranged from latitude 46° to 60-1/2° N.

1011. _______ and Mitchell, A. F.
1966. Differences in phenology of Sitka spruce provenances. *In* Report on forest research for the year ended March 1965. Great Brit. Forest. Comm., pp. 173-184, illus. London: H. M. Stationery Office.

Small unreplicated demonstrations were planted in 1959 and 1960 with 12 provenances of Sitka spruce ranging from Alaska to Oregon, over a range of latitude from 60-1/2° to 43° N. These demonstrations were at four sites at latitudes from 51° N. to 57-1/2° N. They were assessed each year for date of flushing, and their height growth was measured at weekly intervals during the 1959-61 growing seasons. Date of flushing varied more between individual trees than between provenances; the latter differences were small, but the northern provenances tended to flush over a longer period than did the southern ones. The growth pattern also showed considerable variation within a provenance, but the most striking feature was the early cessation of growth on the provenances from northern Alaska, which stopped growing in midsummer when the southern provenances had completed only half of their annual height growth. Photoperiod or critical day length is suggested as the cause of growth cessation, as it was also found that the average date when the provenances stopped growing was related to latitude of the experimental site; the provenances continued to grow for the longest period at the most northerly site. (Author's summary.)

1012. _______, Neustein, S. A., Henman, D. W., and Atterson, J.
1966. Species trials. *In* Report on forest research for the year ended March 1965. Great Brit. Forest. Comm., pp. 33-34. London: H. M. Stationery Office.

The first of a small series of plots comparing *Picea* X *lutzii* with Sitka spruce was planted in eastern Britain. Theoretically, the hybrid may withstand moisture stress better than Sitka spruce.

1013. _______ and Nimmo, M.
1966. Long-term mixtures. *In* Report on forest research for the year ended March 1965. Great Brit. Forest. Comm., pp. 35-38. London: H. M. Stationery Office.

Describes 10-year survival and growth of mixed Sitka spruce-western hemlock plantations on four exposed sites in southern Wales. Sitka spruce survived better and grew taller than western hemlock. Western hemlock seemed to benefit from the shelter of Sitka spruce in the mixed as compared with pure plantations.

1014. Lines, Roger.
1965. Provenance and the supply of forest tree seed. Quart. J. Forest. 59(1): 7-15.

Suitable and unsuitable sources for nine tree species, including Sitka spruce, are given. Generally suitable provenances for Sitka spruce plantings in Britain are Queen Charlotte and Vancouver Island, B. C.; Washington, suitable in southwest England; California generally unsuitable. Alaskan provenances may suffer from autumn frost. All provenances may suffer from spring frost. General findings applicable to all species are discussed.

1015. Little, Elbert L., Jr.
1944. Notes on nomenclature in Pinaceae. Amer. J. Bot. 31(9): 587-596.

1016. _______
1949. To know the trees; important forest trees of the United States. U.S. Dep. Agr. Yearbook 1949: 763-814, illus.

1017. ________
1953. A natural hybrid spruce in Alaska. J. Forest. 51: 745-747.

Describes *Picea lutzii*, a new natural hybrid between *P. glauca* and *P. sitchensis* from the Kenai Peninsula, Chugach National Forest, based on herbarium material. The hybrid, which rose naturally from plantations, has been artificially produced in Denmark, where Fabricius and Larsen have recorded and illustrated it. Very fast growth is reported from Sweden.

1018. ________
1953. Checklist of native and naturalized trees of the United States (including Alaska). U.S. Dep. Agr. Handbook 41, 472 pp.

1019. Livingstone, Burton E., and Shreve, Forrest.
1921. The distribution of vegetation in the United States, as related to climatic conditions. Carnegie Inst. Pub. 284, 590 pp.

Sitka spruce inhabits only the northwestern hygrophytic forest.

1020. Lockhart, R. E.
1964. Regeneration following clearcut timber harvest in southeastern Alaska. Western Forest. & Conserv. Ass., Portland, Oreg. Western Reforest. Coord. Comm. Annu. Proc. 1964: 3-5.

1021. ________
1966. Alaska-sized timber sale. J. Forest. 64: 83-86, illus.

1022. Lodewick, J. Elton, and Harrar, Ellwood S.
1937. What wood is that? Timberman 38(8): 33-40, (9): 18-24, illus.

1023. Løfting, E. C. L.
1937. Hedeskovenes Foryngelse: V. Rodfordaerverangrebenes betydning for Sitkagrans anvendelighed I klitter og heder. [The significance of the attacks of *Polyporus annosus* to the suitability of the Sitka spruce for dunes and heaths.] Forst. Førsogsv. Danmark 14(2): 133-160, illus. [In Danish. English summary.]

1024. Løken, A.
1958. Froets spiring hos Sitkagran og lerk. [Germination of Sitka spruce and larch.] Arsskr. Norske Skogplantesk 1957: 28-35. [In Norwegian.]

Stratification for 7, 15, 30, and 60 days considerably increased both germinative energy and capacity of Sitka spruce and Japanese larch, the effect increasing with duration of stratification.

1025. ________
1959. Spireforsøk i kjølerom. [Germination experiments in a refrigerator chamber.] Medd. Vestlandets Forstl. Forsoeksta. 33: 1-19. [In Norwegian. English summary.]

Scots pine, Norway and Sitka spruce, and Japanese larch seed were tested in a refrigerator kept at 2 to 4° C. In the first experiment, two lots of Sitka spruce seed were germinated in sand in a germinating bell. One lot, exposed to constant light, showed germination of 13.5 and 17.8 percent after

4 and 5 months, respectively, whereas the second lot, kept in complete darkness, showed no sign of germination, possibly because of heavy mold which cemented the seed and sand into an airtight cake. In another series of experiments, seeds of three provenances of pine, four each of Norway and Sitka spruce, and one of Japanese larch, were germinated in a simplified Jakobsen germinator, lit by two 40-watt lamps suspended 70 centimeters above the germination layer. Germination started in pine after 70 days, followed by Norway spruce (70 to 80 days), larch (100 to 120 days), and Sitka spruce (100 to 140 days). Most of the pine seed (81 to 92 percent) had germinated after 220 days; this point was not reached by the other species for 380 days. It is possible that with germination at these low temperatures there is some relationship between date of seed dispersal and speed and extent of germination.

1026. _______
1959. Stratifisering av Sitkagranfrø. [Stratification of Sitka spruce seed.] Arsskr. Norske Skogplantesk 1958: 47-50. [In Norwegian.]

Experiments were made in 1958 with seed from American sources collected in 1957 which germinated much more slowly than Norwegian seed. Seed was stratified for 15, 30, or 60 days either on filter paper in a petri dish or in a cone of filter paper resting in the neck of a widemouth bottle, and the number of seeds germinating in a Jakobsen germinator after 7, 15, and 21 days was determined. Results are tabulated. Seed stratified for 15 and 30 days germinated faster, and those stratified for 60 days slower, than untreated controls. The germination percent of some lots stratified 15 and 30 days was higher and for others lower than in the controls; stratification for 60 days considerably reduced germination compared with controls. A study of the nongerminating seed showed that few were either still living or empty; the percent of dead seed increased considerably with increasing length of stratification, and microscopic examination showed that the seed had been attacked by fungus.

1027. Long-Bell Lumber Company.
1930. Tree planters' guide; the climate and vegetation of the North Pacific coast region. 9 pp, illus. Longview, Wash.

1028. Lotspeich, Fredrick B.
1956. Soil-plant relationships on the Quillayute Prairie in western Clallam County, Washington. 114 pp. (Ph.D. thesis on file at Wash. State Coll.) (Diss. Abstr. 17(1): 3.)

1029. _______ , Secor, Jack B., Okazaki, Rose, and Smith, Henry W.
1961. Vegetation as a soil-forming factor on the Quillayute physiographic unit in western Clallam County, Washington. Ecology 42(1): 53-68, illus.

Vegetation of the prairie is chiefly herbaceous and is dominated by bracken fern. The adjacent climax forest in the spruce-hemlock coastal strip has western hemlock as its dominant tree species. Sitka spruce is shown to be a one-generation seral species in these areas.

1030. Low, A. J.
1964. Compression wood in conifers: a review of literature. Forest. Abstr. 25(3/4): xxxv-xliii, xlv-li.

1031. _______ and Taylor, E. G. M.
1967. Growth problems in pole-stage Sitka spruce. *In* Report on forest research for the year ended March 1967. Great Brit. Forest. Comm., pp. 78-79. London: H. M. Stationery Office.

Two Sitka spruce stands were thinned by removing 30 percent of the standing basal area, in the first by removing dominant and codominant trees, and in the second by removing only small-crowned trees from the lower canopy. Subsequent blowdown was greatest in the stand thinned from above and least in a nearby check area, indicating that thinning from above is undesirable in windthrow-susceptible areas.

1032. Low, J. D., and Gladman, R. J.
1960. *Fomes annosus* in Great Britain; an assessment of the situation in 1959. Great Brit. Forest. Comm. Forest Rec. 41, 22 pp. plus 21 figs.

1033. Lowenberger, Frederick J.
1965. Some silvical and mensurational characteristics of Sitka spruce in the Queen Charlotte Islands. 74 pp., illus., plus map. (B.S. in Forestry thesis on file at Univ. Brit. Columbia.)

Concludes that Sitka spruce plantations do not fail because of grass competition on cutover bottom lands, although grass causes some deformations in young seedlings. Seedling condition was better and browsing less on unburned rather than burned areas, although growth was the same. Burning did not influence distribution of a seedling weevil (*Steremnius carinatus* Boh.). In the Juskatla (Queen Charlotte Islands) area, Sitka spruce is a tolerant tree, and stands are all-aged. Present site index tables for western hemlock are not applicable to spruce as the forms of the two species are different.

1034. Lowry, A. L.
1956. Sitka spruce at Bachelors Lodge. Irish Forest. 13(2): 70-71, illus.

Describes growth at 16 years of Sitka spruce planted in cleared woodland at 9- by 9-foot spacing.

1035. Lunak, S. E.
1918. Effect of varying certain cooking conditions in the production of sulphite pulp from spruce. U.S. Dep. Agr. Bull. 620, 24 pp., illus.

1036. Lutz, H. J.
1930. Observations on invasion of newly formed glacial moraines by trees. Ecology 11: 562-567, illus.

Presents observations made on the vegetational development on newly formed glacial moraines in southwestern Alaska. Pioneer species are *Picea sitchensis*, *Tsuga mertensiana*, *Alnus sinuata*, and *Populus tacamahaca*, in order of abundance.

1037. _______
1951. The concentration of certain chemical elements in the soils of Alaskan archaeological sites. Amer. J. Sci. 249: 925-928.

Determinations were made in the soils of two southeast Alaskan native village sites and in adjacent soils bearing natural forest growth. The food used by primitive man in Alaska was largely of animal origin and was relatively high in certain chemical elements. In time, the soil of the village sites was greatly enriched, with the result that there has been a 50-fold to 175-fold increase in phosphorus, a threefold to sevenfold increase in nitrogen, a fourfold to sixfold increase in potassium, and a twofold to twelvefold increase in calcium.

1038. _______
1963. History of Sitka spruce planted in 1805 at Unalaska Island by the Russians. USDA Forest Serv. Northern Forest Exp. Sta. 25 pp., illus.

The first attempt at tree planting in the Aleutian Islands was made in 1805, inspired by the Russian chamberlain, Rezanov. When last examined (1958) 10 trees were still standing, six alive and four dead. Live trees ranged in height from 24 to 28 feet. Seedlings were found up to 300 feet from the trees.

1039. Luxford, R. F.
1944. Strength of glued laminated Sitka spruce made up of rotary-cut veneers. USDA Forest Serv. Forest Prod. Lab. Rep. 1512, 13 pp.

1040. Lyons, C. P.
1952. Trees, shrubs and flowers to know in British Columbia. 168 pp., illus. Toronto and Vancouver: J. M. Dent & Sons (Canada) Ltd.

1041. _______
1956. Trees, shrubs and flowers to know in Washington. 211 pp., illus. Toronto and Vancouver: J. M. Dent & Sons (Canada) Ltd.

1042. Macaulay Institute for Soil Research.
1957. Forest fertilizer trials. Macaulay Inst. Soil Res. Rep. 1956/57: 52.

Analysis of foliage collected in September 1956 from lodgepole pine and Sitka spruce on deep peat at the Lon Mor indicated a positive correlation between height growth and levels of N, K, and Mg in the foliage of both species in plots that had received P at the time of planting, suggesting that these elements were likely to limit growth in larger trees whose initial P requirements had been satisfied.

1043. _______
1959. Tree growth on deep peat. Macaulay Inst. Soil Res. Rep. 1957/58: 44-45.

Use of the pressure-membrane apparatus to investigate the tensions at which moisture is held in peat under trees suggests that although a reserve of available moisture still exists in the relatively dry peat under the largest trees, temporary moisture shortage may be experienced during a dry summer. An investigation has been started on the marked effect of plough ridge depth on the early growth of lodgepole pine and Sitka spruce on peat at Wauchope Forest.

1044. _______
1960. Forest fertilizer trials. Macaulay Inst. Soil Res. Rep. 1958/59: 15.

Analysis of foliage samples collected at the end of the second growing season from lodgepole pine and Sitka spruce in the N/K/Mg fertilizer trials on deep peat at the Lon Mor showed that the spruce, which grew well earlier as a result of repeated P dressings, was suffering from acute K deficiency. Needle K content increased in the plots with K, and needle N content was slightly increased by the N treatment. Diameter growth during the third growing season showed an increase in the plots with K.

1045. _______
1962. Forest soils: nutrient content of peat. Macaulay Inst. Soil Res. Rep. 1960/61: 14.

Twelve deep-peat sites in Scotland were surveyed and samples were analyzed. Results showed that K deficiency in trees occurs earliest where total K content of peat is lowest, and that, in general, responses to phosphate vary inversely with the total P content of the peat. Sitka spruce has shown good early growth only on sites with a total peat N content of more than 2 percent and a relatively high ash content. These results suggest that a chemical survey of newly acquired deep peat areas might eventually be used to estimate suitability for different tree species and the type and amounts of fertilizers required.

1046. McAvoy, B.
1931. Ecological survey of the Bella Coola region. Bot. Gaz. 92: 141-171.

1047. MacBean, A. P.
1949. Silviculture and cutting methods in British Columbia. Forest. Chron. 25(3): 164-169.

A review of the cutting systems and logging methods used and their effect on regeneration of Douglas-fir, hemlock, Sitka spruce, and ponderosa pine.

1048. McCambridge, W. F.
1956. Effects of black-headed budworm feeding on second-growth western hemlock and Sitka spruce. Soc. Amer. Forest. Proc. 1955: 171-172.

A heavy attack by *Acleris variana* on western hemlock and Sitka spruce in southeast Alaska was studied. Reduction in radial growth appears to be independent of budworm damage. In most cases where tree tops were killed, both species appear to be forming new leaders.

1049. _______
1957. A record of spruce cone insects in Alaska. USDA Forest Serv. Alaska Forest Res. Center Tech. Note 34, 2 pp.

Tabulates results of cone dissections and rearing of larvae from cones of *Picea sitchensis*, *P. sitchensis* X *lutzii*, and *P. glauca*.

1050. _______ and Downing, G. L.
1960. Black-headed budworm. U.S. Dep. Agr. Forest Pest Leafl. 45, 4 pp., illus.

1051. McComb, Fremont, and Munger, T. T.
1940. Roadside windfall in spruce-hemlock. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Forest Res. Note 31, p. 8.

A 4-mile survey of roadsides in a 90-year-old dense spruce-hemlock stand on the Cascade Head Experimental Forest showed over four times as much windfall within 100 feet of roads as between 100 to 200 feet of roads.

1052. McConaghy, S.
1962. The effects of fertilizers on the growth and composition of Sitka spruce. Irish Forest. 19(1): 56-59.

1053. _______, McAllister, J. S. V., Parkin, K. F., and Parker, R. E.
1961. The growth of Sitka spruce on deep peat in Northern Ireland. 1. The effect of fertilizers and other treatments on the growth of young trees. Res. & Exp. Rec. Min. Agr. (Belfast) 10(2): 151-162.

Describes a study of the effects of various treatments on the growth of young Sitka spruce trees on deep peat, with particular reference to the incidence of check. The addition of certain nitrogenous materials to young trees in check produced a temporary improvement in growth and color, but this improvement was not so persistent as that obtained by deepening the main drains and placing the excavated peat around the trees.

1054. McCulloch, Walter F.
1929. Natural regeneration of Sitka spruce on the Queen Charlotte Islands. Forest. Chron. 5(4): 21-23.

Describes a regeneration survey made on all lands cut over during the wartime spruce logging. At least 10 years had elapsed since logging, allowing ample time for early stocking changes, so that the reproduction was considered fairly indicative of the expected mature stand. There is generally good reproduction on the island and fair reproduction of Sitka spruce.

1055. MacDonald, A.
1967. Trial plantations established by the Forestry Commission on the island of Hoy, Orkney. Scot. Forest. 21(3): 163-172.

Sitka spruce, considered one of the best species for exposed sites, proved disappointing.

1056. MacDonald, J.
1928. Growth and yield of conifers in Great Britain. Great Brit. Forest. Comm. Bull. 10, 187 pp., illus.

Contains yield tables for Sitka spruce.

1057. MacDonald, J. A. B.
1953. Thirty years' development of afforestation techniques on difficult ground types in southwest Scotland. Forestry 26(1): 14-21.

Norway and Sitka spruce are the first choice for species to plant on Molinia heath lands following adequate drainage and turnover of turf.

1058. _______
1956. Effect of introducing pine species among checked Sitka spruce on a dry Calluna-clad slope. Scot. Forest. 50: 83-86, illus., plus 1 plate.

Sitka spruce made better growth when planted in mixture with Scots pine than when planted in pure stands.

1059. _______
1963. Thinning to meet today's problems. Forestry 36(2): 165-171.

1060. _______
1967. Norway or Sitka spruce? Forestry 40(2): 129-138.

Norway is the more plastic spruce and can suffer thinner soils and much more drought, but neither spruce is a shallow rooter where soils are good and deep. Of the two, the litter of Sitka is less harmful to the soil. To date there is no evidence that height for height Norway is more stable under high wind pressures, but the belief that it is less sensitive to frost than Sitka is well established. Sitka is far superior to Norway for planting at high altitudes and in exposed places and on Molinia peatlands in Britain, which accounts for the vast preponderance of the American species used in the west and the north of the British Isles. Planting Norway where Sitka could grow well results in only some 75 percent as much volume production. Types of site which each spruce requires and also which each cannot take are considered in detail. (From author's summary.)

1061. _______ and MacDonald, Angus.
1952. The effect of interplanting with pine on the emergence of Sitka spruce from check on heather land. Scot. Forest. 6(3): 77-81, illus.

1062. MacDonald, J. M.
1938. Sitka spruce regeneration at Largie. Scot. Forest. J. 52: 143-144.

1063. MacDonald, James.
1931. Sitka spruce in Great Britain, its growth, production, and thinning. Forestry 5(2): 100-107.

1064. _______
1932. The form of the stem in coniferous trees. Forestry 6: 53-62.

1065. _______
1933. The form of the stem in coniferous trees. Forestry 7(2): 121-129.

Discusses and tabulates form class, root swelling, and bark percentages for several coniferous species including Sitka spruce. Includes a table of bark percentage for Sitka spruce.

1066. _______
1952. The place of northwestern American conifers in British forestry. Sixth Brit. Commonwealth Forest. Conf., Can., 1952; item 7a Silviculture. Great Brit. Forest. Comm., 21 pp.

Western American conifers now account for 23 percent of all conifer plantations in Great Britain. Sitka spruce covers a larger area than any other conifer except Scots pine; Douglas-fir has been extensively used, and increasing use is being made of *Pinus contorta, Tsuga heterophylla, Abies grandis, A. nobilis,* and *Chamaecyparis lawsoniana.* The part played by these species in British forest economy is discussed. Tables are given of the areas occupied by various age classes of each species, and of recorded height growth and volume production at various ages on selected sample plots. Notes are given on the less important forest species. (From author's summary.)

1067. _______, Wood, R. F., Edward, M. V., and Aldhous, J. R.
1957. Exotic forest trees in Great Britain. Great Brit. Forest. Comm. Bull. 30, 167 pp., illus.

Sitka spruce is the most extensively planted exotic in Great Britain. The 1947-49 woodland census showed 167,000 acres, or 9 percent of the entire productive forest area. The species is discussed in detail, including country of origin and provenance, historical notes, extent of planting, climatic requirements, site requirements, establishment techniques (planting and direct seeding), thinning, growth and yield, damage, genetics, natural regeneration, timber, and potentialities in Britain.

1068. MacDonald, J. M.
1956. Thinning Sitka spruce. Scot. Forest. 10(1): 26-30, illus.

Suggests some of the considerations that may apply to the thinning of Sitka spruce plantations in regions of moderate growth. The importance of heavy crown thinning is stressed.

1069. MacDonald, J. Maxwell.
1952. Wind damage in middle-aged crops of Sitka spruce and its prevention. Scot. Forest. 6(3): 82-85.

Gale damage is a serious economic factor on the west coast of Scotland, and Sitka spruce grown in dense even-aged plantations is particularly vulnerable. Suggested counter measures are the development of irregular and mixed crops by crown thinning, strip or group planting, and the planting of very small groups widely spaced over considerable areas, relying on natural regeneration to fill the spaces between groups.

1070. _______ and Lockhart, S. F.
1953. Some early observations on the natural regeneration of conifers in Scotland. Scot. Forest. 7(3): 79-82, 85.

1071. McDowell, D. N.
1955. Pests and diseases of trees and shrubs. Wis. State Dep. Agr. Bull. 330, 88 pp., illus.

Briefly describes *Chrysomyxa ledicola*, a rust which attacks Sitka spruce. Little can be done to control this needle rust under forest conditions.

1072. McElhanney, T. A.
1951. Commercial timbers of Canada, pp. 23-56, illus. *In* Canadian woods; their properties and uses. Ottawa: Queen's Printer.

1073. _______ and Perry, R. S.
1927. Some commercial softwoods of British Columbia; their mechanical and physical properties. Can. Dep. Int. Forest Serv. Bull. 78, 45 pp., illus.

1074. McEvoy, T.
1954. Afforestation of peat soils. Irish Forest. 11(2): 65-75 plus 4 photos.

Gives an account of Irish experiments, based largely on Forestry Commission experience in Great Britain, and differing chiefly in a much more extensive use of lodgepole pine in place of Sitka spruce. A pilot experiment in the afforestation of a blanket bog is described in detail. Paper presented at the International Peat Symposium, Dublin, 1954.

1075. MacGillivray, H. G.
1962. Report on tree improvement at the Acadia Forest Experiment Station, April 1960 - March 1962. Can. Forest. Tree Breeders, 1-14, illus.

Sitka spruce, white spruce, and lots likely to contain hybrids were planted to provide material for breeding, and to see how these lots would perform in east coast areas. Provenances are from Alaska, Canada, and Denmark.

1076. MacGregor, W. D.
1952. Sitka spruce-density survey project. Great Brit. Forest Prod. Res. Lab. Progr. Rep. 1 (Princes Risborough), 6 pp.

Presents density measurements based on ovendry weight and green-volume made on 69 discs taken at various levels from 39 trees in three sample plots in Wales. Mean values show little variation between plots, but the range within plots is high. The oldest plot had the highest and the youngest plot the lowest density. Density becomes lower from 1 foot to 22 feet up the bole of the tree. There is poor correlation between density and annual-ring width, better correlation between density and proportion of summerwood.

1077. McGugan, B. M.
1958. Forest Lepidoptera of Canada, recorded by the forest insect survey. Vol. 1-Papilionidae to Arctiidae. Can. Dep. Agr. Forest Biol. Div. Pub. 1034, 76 pp., illus.

Presents available data on distribution, feeding habits, prevalence, and seasonal occurrence of insects in Papilionidae to Arctiidae families that attack Sitka spruce.

1078. McKay, R.
1957. Note on malformation of Sitka spruce due to drift from hormone weed killer. Irish Forest. 14(2): 98-99.

1079. _______ and Clear, T.
1953. Association of *Rhizina inflata* with group dying of Sitka spruce. Irish Forest. 10(2): 58-59.

Investigation of a typical case of "group dying" in a 30-year-old stand of Sitka spruce showed that roots of all affected trees were completely dead, resin flow was profuse from the base of the stems but there was no stem or butt rot, and the ground around the base of the trees was covered with fructifications of *R. inflata*, a saprophyte that occasionally becomes parasitic.

1080. _______ and Clear, T.
1955. A further note on group dying of Sitka spruce and *Rhizina inflata*. Irish Forest. 12(2): 58-63, illus.

Includes photographs of fructifications of *R. inflata*, enlarged lenticels, and copious resin flow on the stem of a dying tree, and a typical example of group dying.

1081. McKee, M., and Birch, T. C.
1941. Growth of spruce at Conical Hill: a mycorrhizal explanation. New Zealand J. Forest. 4: 311-313.

Of the spruce (*Picea abies* and *P. sitchensis*) planted in Conical Hill State Forest between 1903 and 1916, those in the interior of pure stands are small, undersized trees and yellowish in color, whereas those growing adjacent to pines in particular, and also near Douglas-fir and larch, show a marked increase in size and are a dark, healthy green color. Evidence suggests that the beneficial effects of these conifers is mycorrhizal. The mycorrhizal fungus *Boletus luteus* is prevalent beneath pine stands in this area.

1082. MacKenzie, A. M., and Christie, J. M.
1959. Studies of growth and yield. *In* Report on forest research for the year ended March 1958. Great Brit. Forest. Comm., pp. 79-80. London: H. M. Stationery Office.

1083. MacKenzie, J. M. D.
1945. The preference shown by birds for different species of trees in plantations. Forestry 19: 97-112.

As a result of counts made in about 120 plots, it was found that birds of the thicket type have strong preferences for nesting in certain tree species. Sitka spruce is the most popular species found. The suggestion is made that small plots of Sitka and Norway spruces planted in suitable places in plantations of other species giving bad nest sites will increase the number of birds, and examples are given of plots of this nature found to contain 40 to 50 nests per acre per annum. (From author's summary).

1084. MacLean, Colin D., and Hightree, Paul E.
1959. Forest statistics for Skagit and Whatcom Counties, Washington. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Forest Surv. Rep. 133, 47 pp., illus.

1085. MacLean, J. D.
1945. Effect of heat on the properties and serviceability of wood. USDA Forest Serv. Forest Prod. Lab. R1471, 12 pp. plus tables and figures.

1086. McLeod, A. M., Yolton, L. A., Sanborn, W. A., and Phillips, R. S.
1945. A comparison of shearing strengths of glued joints at various grain directions as determined by four methods of test. USDA Forest Serv. Forest Prod. Lab. Rep. 1522, 9 pp. plus 2 tables and 15 figs.

1087. McMahon, F.
1945. Sitka spruce in Irish forestry. Irish Forest. 2(2): 66-71.

Sitka spruce was first introduced into Ireland as an ornamental tree about 80 years ago. Except for an experimental plot at Avondale, planted about 1905 or 1906, Sitka spruce appears not to have been used in plantations before 1909. Notes are given on its natural habitat, nursery treatment, and subsequent tending.

1088. McMinn, Howard E., and Maino, Evelyn.
1951. An illustrated manual of Pacific coast trees. 409 pp., illus. Berkeley, Los Angeles: Univ. Calif. Press.

1089. McNab, J.
1865. Remarks on some seedling coniferae raised from seed ripened in Britain. Bot. Soc. Trans. (Edinburgh) 8(2): 256-260.

Discusses arboretum specimens of Sitka spruce under the name *Abies menziesii*.

1090. McWilliams, H. G., Webster, L. T., McDaniel, Vern, and others.
1953. Cone collection, preparation and storage. *In* Reports of the Pacific Northwest Seeding and Planting Commission on various recommended reforestation practices and techniques. Western Forest. Conserv. Ass., pp. 15-20.

1091. Madison, Robert W.
1959. Growth and survival of a Sitka spruce plantation in coastal Oregon. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Res. Note 178, 6 pp., illus.

A report on the first 8 years of height growth and survival of Sitka spruce. Total survival for the first eight growing seasons was 80.5 percent. The chief cause of early death was smothering by debris and soil movement, but from 1953 onward competition from vegetation caused most mortality. Planting larger stock to give further initial height advantage is recommended.

1092. _______ and Freed, Virgil H.
1962. Basal treatments for control of salmonberry. Weeds 10(3): 247-248.

Salmonberry (*Rubus spectabilis* Pursh.), a strong competitor of Sitka spruce seedlings, was basally treated in western Oregon during the dormant season and at bud bursting in April, using a 1:1 mixture 2,4-D and 2,4,5-T. January applications gave generally poorer results than those in March and

April. March and April applications produced 100-percent defoliation and kill for all treatments, with only erratic exceptions. Diesel oil alone gave effective control only in April. Sprays containing 2-1/2 percent active ingredients gave as good results as those containing 5 percent.

1093. _______ and Ruth, Robert H.
1962. Basal spraying of red alder. Weeds 10(4): 324-325.

Red alder saplings overtopping Sitka spruce and western hemlock regeneration were readily killed with a basal spray of 2,4-D and 2,4,5-T in diesel oil.

1094. Makins, F. K.
1942. Replanting softwoods. Quart. J. Forest. 36: 70-75.

Calculations based on yield from stands planted on sites of various quality classes show that, under British conditions, Douglas-fir, Sitka spruce, and European larch may be expected to yield higher rates of compound interest than other conifers. Yield tables for various species and quality classes are presented.

1095. Maksymov, Von J. K.
1965. Die Überwinterung des Lärchenblasenfu es *Taeniothrips laricivorus* Kratochvíl und Farský. [Overwintering of the larchthrips *Taeniothrips laricivorus* Krat. and Far.] Mitt. Schweiz Anst. Forstl. Versuchswesen 41(1): 3-18, illus. [In German. English summary.]

The female overwinters on Sitka spruce.

1096. Malcom, D. C.
1967. Environmental factors in the growth of Sitka spruce. *In* Report on forest research for the year ended March 1966. Great Brit. Forest. Comm., pp. 152-153. London: H. M. Stationery Office.

Reports on a project to determine the effect of combinations of locality factors. The project is in the development stage, but early results indicate that there is a relationship between locality factors and productivity.

1097. Manson, Marsdon.
1903. Forest advance over glaciated areas in Alaska and British Columbia. Forest Quart. 1(3): 94-96 plus 1 plate.

Describes plant succession following glacial retreat of Mendenhall Glacier, Alaska.

1098. Markwardt, L. J.
1930. Comparative strength properties of woods grown in the United States. U.S. Dep. Agr. Tech. Bull. 158, 38 pp.

1099. _______
1931. The distribution and the mechanical properties of Alaska woods. U.S. Dep. Agr. Tech. Bull. 226, 80 pp., illus.

1100. _______
1941. Aircraft woods: their properties, selection, and characteristics. USDA Forest Prod. Lab. Rep. 1079, 51 pp. (Reprint from Nat. Adv. Comm. Aeron. Rep. 354.)

Describes the important characteristics of many woods for aircraft construction, including Sitka spruce.

1101. _______ and Wilson, T. R. C.
1935. Strength and related properties of woods grown in the United States. U.S. Dep. Agr. Tech. Bull. 479, 99 pp., illus.

1102. Martin, Arthur James.
1951. Studies on the holccellulose of Sitka spruce: methylation of spruce holocellulose. 24 pp. (M. S. thesis on file at Univ. Brit. Columbia.)

1103. Maser, Chris.
1967. Black bear damage to Douglas-fir in Oregon. Murrelet 48(2): 34-38.

Reports that Sitka spruce is occasionally damaged along the coast.

1104. Matthews, A. F., Mitchell, A. F., and Faulkner, R.
1961. Forest genetics: selection of plus trees. *In* Report on forest research for the year ended March 1960. Great Brit. Forest. Comm., pp. 54-59. London: H. M. Stationery Office.

1105. Matthews, J. D.
1950. Genetics. *In* Report on forest research for the year ended March 1949. Great Brit. Forest. Comm., pp. 26-29. London: H. M. Stationery Office.

Individuals of Sitka spruce which appear to be able to throw off attack by *Neomyzaphis abietina* have been found in several localities. These have leaves with blunt and shouldered apices and a heavy construction; the leaf section is flat and the twigs are quite glabrous. Individuals of this type can often be spotted in a plantation by their dense, compact crowns, dense and flattened leaf arrangement, and bluish leaf coloration, and where *Neomyzaphis* is prevalent, by a sharp contrast in the intensity of infestation. The possibility that these trees are of hybrid origin is being followed up. Some notes are given on methods of grafting.

1106. _______
1952. Forest genetics: the progress of the general programme of improvement. *In* Report on forest research for the year ended March 1951. Great Brit. Forest. Comm., pp. 74-82. London: H. M. Stationery Office.

1107. _______
1955. Production of seed by forest trees in Britain. *In* Report on Forest research for the year ended March 1954. Great Brit. Forest. Comm., pp. 64-78. London: H. M. Stationery Office.

1108. ________
1962. Seed selection and tree breeding in Britain. Eighth Brit. Commonwealth Forest. Conf., Great Brit. Forest. Comm., 5 pp.

Describes the selection and management of seed production areas in Britain. With the expected improvement from seed produced in managed seed stands, the amount spent on seed can be doubled for fast-growing species such as Sitka spruce.

1109. ________
1963. Some applications of genetics and physiology in thinning. Forestry 36(2): 172-180.

The trend in Britain is toward heavier thinnings made less frequently, with careful choice of the trees retained. A table gives data on the range of maximum mean annual increment, duration of height growth, shade tolerance, needle retention, and age of first good seed crop for several species including Sitka spruce.

1110. Mayer-Krapoll, H.
1961. Beiträge zur forstdüngung: 1. Die düngung der Sitka. [Notes on forest manuring: 1. The manuring of Sitka spruce.] Forst- und Holzwirt. 16(18): 389-390. [In German.]

1111. ________
1964. Forst- düngungsversuche auf Ödland und grenzertragsböden. [Forest fertilizer trials on waste land and marginal land.] Phosphorsaure (Essen) 24(5/6): 213-226, illus. [In German.]

1112. Mayr, Heinrich.
1890. Die Waldungen von Nordamerika ihre Holzarten, deren Anbaufahigkeit und forstlicher wert fur Europa im Allgemeinen und Duetchland insbesonders. [The forests of North America, their tree species, their cultivation possibilities and general forest values for Europe.] 448 pp., illus. Munchen: Univ. Buchhandlung. [In German.]

1113. Meany, Edward S.
1918. Western spruce and the war. Wash. Hist. Quart. 9(4): 255-258.

1114. Megraw, R. A.
1967. A hydrodynamic particulate approach to pit membrane pore size distribution. Forest Prod. J. 17(11): 29-38, illus.

1115. Melchior, G. H.
1961. Versuche mit Gibberellinsäure and Waldbaum-Sämlingen und-Stecklingen. [The effect of gibberellic acid on seedlings and cuttings of forest trees.] Naturwiss. Rep. 48(9): 384, illus. [In German.]

Treatment of 3-year seedlings caused a reduction in leader length of Sitka spruce.

1116. Mentz.
1962. Sicherheit auf windefährdeten Boden Forstamt Barlohe. [Safety on sites with windthrow hazards in Barlohe District.] Allg. Forstz. 17(40): 636-637, 646, illus. [In German.]

Discusses windthrow associated with the heavy gales of 1962 in Schleswig-Holstein. On deep sands, carrying chiefly conifers, damage was severe. Norway spruce, Sitka spruce, and Scots pine suffered almost equally, but the larches and silver fir were largely, and hardwoods completely, windfirm on these sites.

1117. Mergen, F., and Thielges, B. A.
1967. Intraspecific variation in nuclear volume in four conifers. Evolution 21(4): 720-724.

Presents evidence of significant intraspecific variation in diploid nuclear volume, correlated with latitude of seed source, in *Picea glauca, P. sitchensis, Pinus sylvestris,* and *P. banksiana.* Evidence is based on filar micrometer measurements of nuclei from seedling roots of 12 geographic seed sources of each species, representing their full latitudinal range.

1118. Merker, E., and Klein-Krautheim, F.
1940. Der Riesenbastkafer an der Sitkafichte. [The giant bark-beetle (*Dendroctonus micans*) on Sitka spruce.] Allg. Forst- und Jagdzeit. 116: 255-261, illus. [In German.]

D. micans, a common pest of *Picea abies,* attacked *P. sitchensis* and a few *Pinus sylvestris,* but not *Picea abies*, at the Giessen Aboretum. The base of the tree and the roots at some distance from the trunk were generally attacked.

1119. Metcalf, Melvin E., and Hazard, John W.
1964. Forest statistics for northwest Oregon. Pacific Northwest Forest & Range Exp. Sta. USDA Forest Serv. Resource Bull. PNW-7, 38 pp.

1120. Meyer, Walter H.
1937. Yield of even-aged stands of Sitka spruce and western hemlock. U.S. Dep. Agr. Tech. Bull. 544, 86 pp., illus.

Includes a description of the Sitka spruce-western hemlock type, the silvical characteristics of the species, stand tables, and yield tables for mixed spruce-hemlock stands in Oregon, Washington, and Alaska.

1121. _______
1937. Yield tables for trees 6.6 inches and more in diameter in even-aged stands of Sitka spruce and western hemlock. (Supplement to Tech. Bull. 544. Yield of even-aged stands of Sitka spruce and western hemlock.) USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta., 8 pp.

1122. Miller, H. G., and Mackenzie, R. C.
1965. Research on Scottish forest and nursery soils. *In* Report on forest research for the year ended March 1964. Great Brit. Forest. Comm., pp. 83-86. London: H. M. Stationery Office.

1123. Milligan, Frederick H., and Davies, Raymond D.
1963. High-speed drying of western softwoods for exterior plywood. Forest. Prod. J. 13: 23-29, illus.

Describes an experimental veneer dryer. Douglas-fir 1/6-inch heartwood veneer was dried from 5- to 35-percent moisture content in 4.38 minutes at 300° F. and 3,000 feet per minute gas velocity, and in 0.95 minute at 550° and 9,000 feet per minute. Average surface temperatures of the veneer at 5-percent moisture content were 186° and 280°, respectively, and no loss of color, strength, or gluability occurred. Similar results were obtained for Douglas-fir sapwood, and for Sitka spruce, west coast hemlock, and west coast balsam fir.

1124. Minore, Don.
1966. Identification of rotten logs in the coastal forests of Oregon and Washington. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. 16 pp., illus.

Sitka spruce logs decay rather uniformly, and sound wood is rare when the outer portions are rotten and crumbly. An identification key is presented.

1125. Mitchell, A. F.
1965. The growth in early life of the leading shoot of some conifers. Forestry 38(1): 121-136.

1126. Mitchell, C., and Mitchison, I.
1950. Windblown Sitka spruce. Quart. J. Forest. 44(3): 149-150 plus 2 photos.

Stands of Sitka spruce in Kyloe Wood, Northumberland, were devastated by windthrow during gales in December 1949. The trees had been dèfoliated by "aphis" for several years in succession and this may have weakened their roots.

1127. Mocanu, V. G.
1955. Exoticele din parcul Calea-Codrului Ocolul silvic experimental-didactic Sinaia. [Trials of exotics in the Calea-Codru Park in the Sinaia experimental teaching circle.] Padurilor Rev. 70(6): 297-298. [In Rumanian.]

1128. Molnar, A. C.
1955. Province of British Columbia. Forest disease survey. Dep. Agr. Forest Insect & Dis. Surv. Annu. Rep. 1954: 128-135, illus.

1129. _______
1956. Province of British Columbia. Forest disease survey. Dep. Agr. Forest Insect & Dis. Surv. Annu. Rep. 1955: 102-106.

1130. _______ , Harris, J. W. E., and Ross, D. A.
1965. British Columbia region. Can. Dep. Forest., Forest Insect & Dis. Surv., pp. 93-109, illus.

1131. _______ , Harris, J. W. E., Ross, D. A., and Ginns, J. H.
1967. British Columbia region. Can. Dep. Forest., Forest Insect & Dis. Surv., pp. 108-124, illus.

Contains notes on several insect pests of Sitka spruce. Also lists the first record of western dwarf mistletoe on Sitka spruce in British Columbia, from Radley Park, Kitimat.

1132. Mooney, O. V.
1960. Some notes on shelterbelts in Irish coastal regions. Irish Forest. 17(2): 53-56.

Discusses choice of species, width, and spacing within and between rows. For peats, *Pinus contorta* is recommended, with *P. mugo* in mixtures only, and *Picea sitchensis* only for wider belts on better peats or moist soils.

1133. ______
1965. A background to silviculture in Irish forestry. Forestry 38(1): 8-19.

The writer traces the history of tree species and woodland in Ireland from early times down to the start of state forestry about 1906. He then considers the influence which the availability of land, the geology, the distribution of forest types, and the climate have had on silviculture since. He discusses the main species used, pure and in mixture, and notes that the type of ground available is the main limiting factor in the choice of species and that the tendency today is toward a very limited range of species in which *Picea sitchensis* and *Pinus contorta* have an important part to play. (Author's summary.)

1134. Moore, A. W.
1940. Wild animal damage to seed and seedlings on cutover Douglas-fir lands of Oregon and Washington. U.S. Dep. Agr. Tech. Bull. 706, 28 pp., illus.

In the fall of 1909 and following spring and fall, 4,000 acres were sown to Douglas-fir, Sitka spruce, and other species on a burned-over area on the Siuslaw National Forest, Oregon. An unpublished report stated, "Operation almost a complete failure."

1135. Moravets, F. L.
1943. The forest resource. *In* Forest resources of Oregon. Part I. Oregon State Board Forest. & Oregon State Coll. Sch. Forest., pp. 7-28, illus.

1136. ______
1949. Production of lumber in Oregon and Washington, 1869-1948. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Forest Surv. Rep. 100, 12 pp.

1137. ______
1953. Forest statistics for Grays Harbor County, Washington. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Forest Surv. Rep. 111, 24 pp., illus.

1138. Morris, William G.
1934. Forest fires in western Oregon and western Washington. Oreg. Hist. Quart. 35: 313-339.

Reports early conflagrations, several of which destroyed large acreages of Sitka spruce-western hemlock timber.

1139. _______
1936. The Tillamook burn--its area and timber volume. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Note 18, 3 pp.

Shows volume of timber killed by species and ownership class. The total volume of Sitka spruce over 16 inches in diameter killed was 131 million board feet.

1140. Morton, B. R., and Lewis, R. G.
1917. Native trees of Canada. Can. Dep. Int. Forest. Br. Bull. 61, 233 pp., illus.

Gives range and description of Sitka spruce in Canada.

1141. Mosher, Milton M., and Lunnum, Knut.
1953. Trees of Washington. (Rev.) Wash. State Coll., Wash. Ext. Serv. Bull. 440, 40 pp., illus.

1142. Mounce, I.
1927. "Dote" disease of Sitka spruce (*Picea sitchensis* Carr.). Dominion Bot., Ottawa 1926: 20-24.

1143. Muenscher, W. C.
1941. Flora of Whatcom County. State of Washington; vascular plants. 139 pp., illus. Ithaca, New York: William A. Church Co.

1144. Muir, John.
1915. Travels in Alaska. 327 pp., illus. Boston and New York: Houghton Mifflin Co.

1145. Mulholland, F. D.
1937. The forest resources of British Columbia. Dep. Lands, Brit. Columbia Forest Serv., 153 pp., illus.

1146. Mulholland, Jack R.
1954. Changes in weight and strength of Sitka spruce associated with decay by a brown-rot fungus, *Poria monticola*. J. Forest Prod. Res. Soc. 4(6): 410-416, illus.

1147. Munger, Thornton T.
1945. A check list of the trees native to Oregon and Washington. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta., 5 pp.

1148. _______
1945. Growth records of some permanent sample plots in Douglas-fir and spruce-hemlock. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta., 6 pp.

1149. _______
1946. Windfall in relation to cutting. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Res. Note 34: 11-12.

Windfall in Sitka spruce, western hemlock, and Douglas-fir stands on the Cascade Head Experimental Forest was several times greater in the

100-foot zone nearest the cutting edge than in the next 100-foot zone. Windfall was also heavy within 100 feet of a road. Right-of-way clearing through tall, dense timber should be of minimum width consistent with other considerations.

1150. _______
1946. Sample acres prove point; 17,523 board feet in 11 years. The Timberman 47(5): 48-50, illus.

Describes growth of spruce-hemlock plots in Oregon.

1151. _______
1947. The Wind River Arboretum from 1937 to 1946. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Progr. Rep. 3, 21 pp. plus 8 figs.

1152. _______ and Greeley, W. B.
1927. Timber growing and logging practice in the Douglas-fir region. U.S. Dep. Agr. Dep. Bull. 1493, 42 pp., illus.

1153. _______ and Kachin, Theodore.
1949. Multiple-spur climbers for high pruning. J. Forest. 47: 375-377, illus.

1154. Munns, E. N.
1938. The distribution of important forest trees of the United States. U.S. Dep. Agr. Misc. Pub. 287, 176 pp., illus.

1155. Munro, Donald D.
1967. Ratios of standard cubic-foot volume to basal area for the commercial tree species of British Columbia. Fac. Forest., Univ. Brit. Columbia. 1 p. plus 24 tables.

Gives tables designed for use in compilation of variable-plot or "prism" cruises.

1156. Murphy, P. W.
1953. Soil faunal investigations. *In* Report on forest research for the year ended March 1952. Great Brit. Forest. Comm., pp. 123-126. London: H. M. Stationery Office.

Outlines the quantitative structure and vertical distribution of the fauna in natural heathland and cultivated heathland planted with Sitka spruce. The populations obtained from these habitats represent 570,000 and 835,000 organisms per square meter, respectively. In the natural heathland, this total is concentrated in the first 2-1/2 inches of the profile, whereas in the cultivated site, in addition to the litter fauna, there is a considerable percent in the raw-humus "sandwich" created in the cultivation process.

1157. Murray, J. S.
1954. Two diseases of spruce under investigation in Great Britain. Forestry 27(1): 54-62 plus 1 plate.

Descriptions are given of two apparently distinct diseases. One, termed "group dying," occurs mostly in Sitka spruce but sometimes in Norway spruce and is characterized by progressive death of the roots and a tendency for the trees to die in small groups in the stand. Trees between 20 and 30 years of age are usually attacked. The second disease is termed "top dying" and is confined to Norway spruce. (From author's summary.)

1158. _______
1955. Rusts of British forest trees. Great Brit. Forest. Comm. Booklet 4, 15 pp. plus 13 figs.

1159. _______ and Young, C. W. T.
1961. Group dying of conifers. Great Brit. Forest. Comm. Forest Rec. 46, 19 pp. plus 12 figs.

1160. Murray, James S.
1953. Group dying of spruce in Eire. Irish Forest. 10(2): 55-56.

Presents notes from Ireland on several examples of a disease, already under investigation in Great Britain, characterized by death of the root system and thinning of the crown, reduction in height increment, and unusually heavy cone production before death.

1161. _______
1955. *Rhizina inflata* associated with group dying of conifers in Britain. FAO Plant Protect. Bull. 4(1): 6.

Describes group dying of Sitka spruce and other tree species in west Britain and Ireland. A survey has shown a general association with the mealtime fires lit by workmen. The usually saprophytic *Rhizina* fruits vigorously on the charcoal, and fruit bodies are common on the ground in the groups. The majority of cases have also followed the first thinning, when such fires are lit. Mycelia have been traced to dark necrotic spots in the cortical tissues of dead tree roots. The gradual death of the roots is followed by a thinning of foliage and a slowing down of increment.

1162. Mustanoja, K. J., and Leaf, A. L.
1965. Forest fertilization research, 1957-64. Bot. Rev. 31(2): 151-246.

Gives a bibliography of forest fertilization research, containing many reports of work done with Sitka spruce.

1163. Nairn, Patrick.
1957. A second collection of wood specimens with 100 reproductions in colour. 206 pp., illus. London: Tothill Press.

1164. Nearn, W. T.
1955. Effect of water soluble extractives on the volumetric shrinkage and equilibrium moisture content of eleven tropical and domestic woods. Penn. Agr. Exp. Sta. (Forest. School Ser. 2) Bull. 598, 38 pp.

Describes the effect of extractives in certain species, including Sitka spruce, that show an abnormally low volumetric shrinkage for their specific gravity class. Test methods and data are given in detail and the results discussed. It is concluded that the low volumetric shrinkage is a result of their low fiber-saturation point.

1165. Nedkvitne, Knut.
1964. En vurdering av dyrkningsverdien til utenlandske bartrearter pa Vestlandet og deira plass i landsdelen sitt skogbruk i framtida. [An estimation of the value of some exotic conifers for cultivation in western Norway and their place in the future forestry of the region.] Norsk Skogbruk 10 (13/14): 385-390, illus. [In Norwegian.]

Gives notes on the performance, pests, and diseases of several conifer species, including Sitka spruce.

1166. _______ and Troen, Ingvald.
1961. Nokre forsok med gjodsling og andre tiltak i Sitka-granplantingar pa lyngmark pa Vestlandet. [Trials of fertilizing and other measures in Sitka spruce plantations on heathland in Vestland.] Tidsskr. Skogbruk 69(1): 26-39, illus. [In Norwegian.]

1167. Nelson, Urban C.
1960. The forest-wildlife resources of Alaska. J. Forest. 58: 461-464, illus.

1168. Nemec, A.
1950. Hnojeni lesnich kultur: meliorace krnicich kultur a porostu. [The manuring of forest plantations: amelioration of checked plantations and stands.] Sb. vyzkumn Ust. Les. CSR 3, 437 pp. [In Czech. English summary.]

1169. Neustein, S. A.
1965. Direct sowing of Sitka spruce. *In* Report on forest research for the year ended March 1964. Great Brit. Forest. Comm., p. 26. London: H. M. Stationery Office.

1170. _______
1965. Investigations at sites of windthrow. *In* Report on forest research for the year ended March 1964. Great Brit. Forest. Comm., pp. 36-37. London: H. M. Stationery Office.

1171. _______
1965. Windthrow on the margins of various sizes of felling areas. *In* Report on forest research for the year ended March 1964. Great Brit. Forest. Comm., pp. 166-171, illus. London: H. M. Stationery Office.

1172. _______
1966. Direct sowing of Sitka spruce. *In* Report on forest research for the year ended March 1965. Great Brit. Forest. Comm., p. 33. London: H. M. Stationery Office.

1173. _______
1966. Trial plantations at high elevations. *In* Report on forest research for the year ended March 1965. Great Brit. Forest. Comm., pp. 169-172. London: H. M. Stationery Office.

1174. _______
1967. Mixtures of lodgepole pine and Sitka spruce. *In* Report on forest research for the year ended March 1967. Great Brit. Forest. Comm., p. 77. London: H. M. Stationery Office.

A survey of 91 stands of mixed lodgepole pine and Sitka spruce indicated that potential economic gains by an admixture of less than 50 percent spruce are not expected to be high.

1175. _______
1967. Slash disposal for regeneration. Fourteenth Congr. Int. Union Forest Res. Proc. Part IV, Sect. 23: 456-464.

Discusses alternative methods of slash disposal after clearcutting of planted Sitka spruce in Great Britain.

1176. _______
1967. Theoretical comparison of net discounted revenue of pure lodgepole pine and pure Sitka spruce on infertile peat. *In* Report on forest research for the year ended March 1966. Great Brit. Forest. Comm., pp. 37-38. London: H. M. Stationery Office.

Describes briefly an investigation to determine the economics of fertilizing Sitka spruce and lodgepole pine on infertile peat.

1177. Newlin, J. A., and Wilson, Thomas R. C.
1917. Mechanical properties of woods grown in the United States. U. S. Dep. Agr. Bull. 556, 28 pp., illus.

1178. Newport, Carl A., and Metcalf, Melvin E.
1965. Timber resource statistics for the Pacific Northwest as of January 1, 1963. Pacific Northwest Forest & Range Exp. Sta. USDA Forest Serv. Resource Bull. PNW-9, 38 pp.

1179. Nimmo, M.
1950. Planting experiments on lowland heaths. *In* Report on forest research for the year ended March 1949. Great Brit. Forest. Comm., pp. 48-50. London: H. M. Stationery Office.

1180. _______
1953. The 1945 broom and pine nursing experiments at Coldharbour, Wareham Forest, Dorset. *In* Report on forest research for the year ended March 1952. Great Brit. Forest. Comm., pp. 31-33 plus 2 photos. London: H. M. Stationery Office.

1181. Noble, Mary, de Tempe, J., and Neergaard, Paul.
1958. An annotated list of seed-borne diseases. Commonwealth Mycol. Inst. 159 pp.

The list is arranged under families of the hosts, with an index to pathogens, and indexes to common and Latin names of hosts, including Sitka spruce.

1182. Nobles, M. K.
1943. A contribution towards a clarification of the *Trametes serialis* complex. Can. J. Res. Rep. 21: 211-234 plus 4 plates.

The fungus frequently isolated from a destructive, brown cubical rot in Sitka spruce and Douglas-fir, and formerly referred to as *Trametes serialis*, Fries, has been connected with a fruit body collected on Sitka spruce in the Queen Charlotte Islands, B.C. By means of morphological, cultural, and interfertility studies it has been shown to be distinct from *Trametes serialis* and is described herewith under the name *Poria micropora* Overholts, n. sp. Similar studies of *Poria sequoiae* Bonar, *Polyporus palustris* Berk., and *Poria carbonicaa* Overholts, n. sp., all of which have been confused with *Trametes serialis* because of similarities between fruit bodies or cultures, have demonstrated the validity of each of the species and have provided criteria for their separation on the basis of cultural characters. (Author's summary.)

1183. Nokihara, Ezio; Tuttle, M. Jean; Felicetta, Vincent; and McCarthy, Joseph L.
1957. Lignin. VIII. Molecular weights of lignin sulfonates during delignification by bisulfite-sulfurous acid solutions. J. Amer. Chem. Soc. 79(16): 4495-4499, illus.

Discusses lignin sulfonates of *Tsuga heterophylla, Picea sitchensis,* and *Acer saccharum.*

1184. Nyholm, I.
1950. Anvendelse af flammekaster og hojtraffinerede petroleumsnaftaer til ukrudtsbekaempelse I planteskolerne. [Use of flamethrowers and highly refined petroleum oils for weed control in nurseries.] Dansk Skovforen. Tidsskr. 35(10): 528-536. [In Danish.]

1185. Oakleaf, Howard B.
1911. Wood-using industries of Oregon: with special reference to the properties and uses of Oregon woods. 46 pp. Portland: Oregon Conserv. Ass.

1186. O'Carroll, N.
1962. The progress of peatland afforestation in the republic of Ireland. Irish Forest. 19(1): 93-101.

1187. _______
1967. Fertilizers at planting time. Dep. Lands, Ireland, Forest. Div. Forest Res. Rev. 1957/64: 27-31.

1188. _______
1967. Season and time of planting. Dep. Lands, Ireland, Forest. Div. Forest Res. Rev. 1957/64: 31-32.

1189. _______
1967. Early growth of conifers on machine-cutover peatland. Fourteenth IUFRO-Kongress Pap. (Munchen) 9 (sec. 23 no. 4): 471-482, illus.

1190. _______ and O'Muirgheasa, N.
1963. The estimation of heart rot in standing crops; a note. Irish Forest. 20(1): 16-17.

A limited investigation in 56-year Sitka spruce suggests that the presence of markedly swollen butts is not related to the presence of heart rot, and that estimates of the percent of affected trees in a standing crop based on observations from recent thinnings are apt to be exaggerated. (From author's summary.)

1191. O'Driscoll, J.
1967. Provenance trials. Dep. Lands, Ireland, Forest. Div. Forest Res. Rev. 1957/64: 12-22.

Describes provenance trials with 10 Sitka spruce seed origins from Oregon to Alaska. At the end of the third growing season, average height ranged from 1.6 feet (Cordova, Alaska) to 3 feet (Sooke, Vancouver Island). Frost hardiness of various provenances is discussed.

1192. Oedekoven, Karl.
1957. European experiences with Douglas and other conifers from western North America. Irish Forest. 15(1): 12-31.

Species discussed are Douglas-fir, western hemlock, western redcedar, and Sitka spruce.

1193. Øglaend, I.
1963. Rotrate pa Sitka. [Root rot of Sitka spruce.] Norsk Skogbruk 9(21): 616. [In Norwegian.]

1194. Øglaend, Ingar.
1961. Planter i plastpose. [Plants in plastic bags.] Norsk Skogbruk 7(19): 655. [In Norwegian.]

Sitka spruce planting stock (2 + 1) sealed in plastic bags in April and kept in shade were in good condition a month later. Those kept in perforated bags were in poorer condition in May. Spruce from the perforated bags transferred to sound bags in May and kept till June were damaged by mold, and some were dead when the bags were opened.

1195. Ohnesorge, B.
1959. Die Massenvermehrung der Sitkalaus in Nordwestdeutschland. [The outbreak of *Liosomaphis* (*Neomyzaphis*) *abietina* in northwest Germany.] Forstarchiv 30(4/5): 73-78, illus. [In German.]

1196. _______
1961. Wann sind Schäden durch die Sitkalaus zu erwarten? [When must we expect outbreaks of *Liosomaphis abietina*?] Allg. Forstz. 16(27/28): 408-410, illus. [In German.]

1197. Oksbjerg, E.
1952. Saltnedslag, en klimatisk faktor. [Salt deposition, a climatic factor.] Dansk Skovforen. Tidsskr. 37(8): 375-389. [In Danish.]

1198. _______
1960. Nogle iagttagelser over rodfordaerverangreb på Sitkagran i en midt- og en vestjydsk plantage. [Some observations regarding *Fomes annosus* attacks on Sitka spruce in plantations in central and western Jutland.] Dansk Skovforen. Tidsskr. 45(9): 345-372. [In Danish. English summary.]

1199. _______
1965. Tre nåletraearter i Midtjylland. [Three conifer species in mid-Jutland.] Hedeselsk. Tidsskr. 86(6): 113-128, illus. [In Danish.]

1200. _______
1965. Tre nåletraearters forhold. [Light relations of three conifers.] Hedeselsk. Tidsskr. 86(16): 367-374, illus. [In Danish.]

1201. _______
1966. Tre nåletraearters skudvaekst og frostfølsomhed. [The shoot growth and susceptibility to frost of three conifers.] Hedeselsk. Tidsskr. 87(13): 359-371, illus. [In Danish.]

1202. _______ and West-Nielsen, G.
1953. Om rodfordoerverangreb. [Damage to spruce by *Fomes annosus*.] Hedeselsk. Tidsskr. 74(15): 319-334, illus. (In Danish.]

1203. Oliver, Frank.
1966. Early thinnings of Sitka spruce. Scot. Forest. 20(2): 104-108.

1204. O'Muirgheasa, Niall.
1964. The pattern of annual growth in basal area of Sitka spruce, Norway spruce, and *Pinus contorta* in Ireland. Irish Forest. 21(2): 63-73.

1205. _______
1967. Inventory; census of woodlands, 1958/59; census extracts; volume sampling survey extracts. Dep. Lands, Ireland. Forest. Div. Forest Res. Rev. 1957/64: 83-114.

1206. Oosting, Henry J.
1956. The study of plant communities; and introduction to plant ecology. Ed. 2, 440 pp., illus. San Francisco: W. H. Freeman Co.

Describes briefly the tree associates of Sitka spruce throughout its natural range.

1207. Opperman, A.
1922. Sitkagranens vaekst i Danmark. [The Sitka spruce in Denmark.] Forstl. Forsogsv. Danmark. (Copenhagen) 6: 361-374, illus. [In Danish. English summary.]

Sitka spruce was introduced into Denmark about the same time as Douglas-fir, but it was rarely planted before 1890. In suitable spots growth rate is good, but in others, root rot, frost, and wind have caused damage. The species is now found in plantations throughout the country, and experience will eventually determine its place in Danish forestry. Information on growth rate and health is given.

1208. _______
1929. Racer af Douglasie og Sitkagran. [Races of Douglas-fir and Sitka spruce.] Saertryk af det Forstl. Forsøgsv. Danmark. beretning no. 90: 85-178. [In Danish. English summary.]

Describes provenance experiments with Douglas-fir and Sitka spruce from North America.

1209. Oregon Woodland Publication Council.
1963. Woodland handbook for the Pacific Northwest. 422 pp., illus. Coop. Ext. Serv. Corvallis: Oregon State Univ.

1210. Orloci, Laszlo.
1961. Forest types of the western hemlock zone. 206 pp., illus. (M.S. thesis on file at Univ. Brit. Columbia.)

Presents an ecosystem classification of the forest stands of the coastal western hemlock zone. Sitka spruce is shown to be an inhabitant of the wet edaphic habitats.

1211. _______
1964. Vegetational and environmental variations in the ecosystems of the coastal western hemlock zone. 204 pp., illus. (Ph.D. thesis on file at Univ. Brit. Columbia.)

1212. _______
1965. The coastal western-hemlock zone on the southwestern British Columbia mainland, vegetation-environmental patterns and ecosystem classification. *In* Ecology of western North America, V. J. Krajina [ed.], vol. 1, pp. 18-34. Univ. Brit. Columbia, Dep. Bot.

1213. Orr, P. W.
1963. Windthrown timber survey in the Pacific Northwest, 1962. USDA Forest Serv. Pacific Northwest Reg., 22 pp., illus.

The October 12, 1962, storm blew down an estimated 11.19 billion board feet of timber in Oregon and Washington including a considerable volume of Sitka spruce.

1214. _______
1966. Forest insect conditions in the various regions. Oregon and Washington. *In* Forest insect conditions in the United States, 1965, pp. 7-12, illus. USDA Forest Serv.

1215. _______, Pettinger, L. S., and Dolph, R. E.
1966. Forest insect conditions in the Pacific Northwest during 1965. USDA Forest Serv. Pacific Northwest Reg., 70 pp., illus.

Similar reports have been issued annually by the Insect Control Branch since 1962 and by the Pacific Northwest Forest and Range Experiment Station since about 1956. Earlier reports were by the Bureau of Entomology and Plant Quarantine.

1216. Osgood, Wilfred H.
1901. Natural history of the Queen Charlotte Islands, British Columbia. Natural history of the Cook Inlet Region, Alaska. U.S. Dep. Agr. Div. Biol. Surv., North Amer. Fauna 21, 87 pp., illus.

1217. Osmaston, F. C.
1955. Thoughts on yield tables. Forestry 28(2): 117-124.

Examines the recently published Forestry Commission Record, "Revised Yield Tables for Conifers in Great Britain," and shows how the standing volume, basal area, numbers of trees, and mean quartergirth vary with the mean top height, irrespective of age and quality class. By analogy with the Indian Forest Record, "Multiple Yield Tables for Deodar (*Cedrus deodara*)," he concludes that treatment does not materially affect this relationship. A modified yield table for Sitka spruce based on mean top height only is given. (From author's summary.)

1218. Ostrom, Carl E.
1960. Potentialities for improving forest growth. *In* Southern forest soils. Eighth Annual Forestry Symposium Proc., pp. 120-132, illus. Baton Rouge: Louisiana State Univ. Press.

Coastal Sitka spruce-western hemlock forests are second only to the coastal redwood type in northern California in natural timber production rates in the United States.

1219. Ouellette, G. B., and Magasi, L. P.
1966. *Lophomerum*, a new genus of Hypodermataceae. Mycology 58(2): 275-280.

Describes *Lophomerum septatum* sp. from needles of Sitka spruce.

1220. Ovington, J. D.
1953. Studies of the development of woodland conditions under different trees. 1. Soils pH. J. Ecol. 41(1): 13-34, illus.

1221. _______ and Madgwick, H. A. I.
1957. Afforestation and soil reaction. J. Soil Sci. 8(1): 141-149, illus.

Describes a study of the pH relationships between the soil, litter, and tree leaves at 10 experimental areas from 17 to 50 years after planting. At each of these areas a number of different tree species has been established, including Sitka spruce.

1222. Owen, T. H.
1954. Observations on the monthly litter-fall and nutrient content of Sitka spruce litter. Forestry 27(1): 7-15, illus.

The monthly needle-litter deposition in a 30-year-old Sitka spruce plantation was recorded over 2 years and the litter samples were analyzed. Seasonal variation was found both in the amount and in the nutrient content of the litter-fall. Most fell in late autumn and spring, least from June to September. The Ca content increased from May to November, while N and the other minerals decreased over the same period. Average total annual litter-fall was 1,832 pounds per acre; average nutrient contents, expressed as percent dry weight: Ca, 0.366; N, 1.085; K, 0.26; P, 0.24; and ash, 3.35. In comparison with results recorded in Europe and America for other conifers, the Ca content of the litter is low, but since the total amount of litter deposited annually is small, and the content of other minerals is relatively high, it is suggested that pure Sitka spruce plantations may not necessarily lead to soil deterioration. (From author's summary.)

1223. Owens, Charles E.

1936. Studies on the wood-rotting fungus *Fomes pini*. I. Variations in morphology and growth habit. Amer. J. Bot. 23: 144-149.

Discusses several tree species including Sitka spruce.

1224. Pacific Lumber Inspection Bureau, Inc.

1950. Export R. List. Grading and dressing rules, Douglas-fir, Pacific coast hemlock, Sitka spruce and western redcedar lumber. Seattle, Wash., 130 pp.

1225. Packman, D. F., and Laidlaw, R. A.

1966. Pulping of British grown softwoods. Part III. Variation in the pulping properties of Sitka spruce (*Picea sitchensis*). Holzforschung 20(5): 155-159.

Describes pulping properties of wood samples from stands 33 and 40 years old on the east and west coasts of Scotland. Mean fiber length was greater in high-density samples, and properties of pulp made by sulfite, kraft, and mechanical processes were related to density and fiber length.

1226. _______ and Orsler, R. J.

1964. Sulphite pulping of British-grown softwoods. I. Two-stage cooking of Sitka spruce. Holzforschung 18(6): 179-183, illus.

1227. Panshin, A. J., DeZeeuw, Carl, and Brown, H. P.

1964. Textbook of wood technology. Ed. 2, vol. 1, 643 pp., illus. New York: McGraw-Hill Book Co.

Contains information on structure, identification, uses, and properties of commercial woods of the United States including Sitka spruce.

1228. Parde, J.

1960. Contribution a l'étude de la productivite des reboisements de la région du plateau de Millevaches. [The productivity of the plantations on the Millevaches.] Rev. Forest. Franc. 12(8/9): 557-571, illus. [In French.]

1229. _______

1962. Aperçu sur la productivité des plantations resineuses en Bretagne. [The increment and yield of coniferous plantations in Brittany.] Rev. Forest. Franc. 14(5): 402-416. [In French.]

Deals mainly with the growth and yield of tree species that have passed the experimental stage, including Sitka spruce.

1230. Parker, R. E.

1957. Some problems arising in the afforestation of peat-land in northern Ireland. Irish Forest. 14(2): 118-121.

Describes the need for work on a vegetation classification and site-evaluation scheme, on treatments to prevent or overcome early check in Sitka spruce on *Calluna* sites, and on the effect of *Sphagnum* on trees, especially in stands opened up by thinning.

1231. _______
1962. The problems of peatland forestry. Irish Forest. 19(1): 3-14, illus.

Describes peatlands and problems encountered in establishing and growing timber on them in Ireland. On many sites Sitka spruce passes into a state of check a few years after planting. This condition is attributed to nitrogen starvation due to unsuccessful competition with *Calluna*.

1232. _______
1962. Factors limiting tree growth on peat soils. An investigation into the nutrient status of two peatland plantations. Irish Forest. 19(1): 60-81, illus.

Foliage analysis of two representative Sitka spruce plantations in northern Ireland led to a firm diagnosis of nitrogen deficiencies and a less firm diagnosis of phosphorous and potassium deficiencies. Tree and soil nutrient relationships are discussed.

1233. Parkin, K. F.
1957. Afforestation of peat-lands in northern Ireland. Irish Forest. 14(2): 111-117.

1234. Parlatore, P.
1868. *Picea menziesii*. *In* Prodromus septematis naturalis regni vegetabilis, A. P. de Candolle and A. de Candolle [eds.], [One of the seven leaders in vegetation.] Vol. 16, part 2, pp. 418-419. Paris. [In Latin.]

1235. Paton, J. M., and Hearmon, R. F. S.
1957. Effect of exposure to Gamma-rays on the hygroscopicity of Sitka spruce wood. Nature 180(4587): 651, illus.

Hygroscopicity (and possibly other physical properties) of the wood appears to be affected only by very heavy doses of radiation; at less than about 10^7 rad, the effect is negligible. In connection with insect control, doses not exceeding 60,000 rad and often considerably less have been mentioned. It is concluded that such low doses are unlikely to have any significant physical effect on the wood itself.

1236. Patric, J. H.
1966. Rainfall interception by mature coniferous forests of southeast Alaska. Soil & Water Conserv. 21(6): 229-231, illus.

Rainfall interception loss was measured in a mature stand of western hemlock-Sitka spruce. Interception loss of about 25 percent of the annual rainfall must be accounted for in the forest water budget of southeast Alaska.

1237. _______
1967. Frost depth in forest soils near Juneau, Alaska. Pacific Northwest Forest & Range Exp. Sta. USDA Forest Serv. Res. Note PNW-60, 7 pp., illus.

Describes frost penetration beneath a mature Sitka spruce-western hemlock forest, on clearcut areas, and on a logging road.

1238. Patscheke, G., and Kerner, G.
1963. Der gerbstoffgehalt von Sitkafichtenrinde. [The tannin content of Sitka spruce bark.] Soz. Forstwiss. (Berlin) 13(11): 328-330, illus. [In German.]

Analytical data are tabulated for two dominant and two suppressed stems to show differences in tannin content with height in the stem and with bark thickness. The mean content of single stems varied from 16.5 to 22.6 percent. The yield of dry substance from bark is estimated at 7 to 9 kilograms for the smallest second-class stem and 20 to 26 kilograms for the largest first-class stem. It is concluded that European-grown Sitka spruce constitutes a useful tannin source worth investigation by the leather industry.

1239. Paul, Benson H.
1963. The application of silviculture in controlling the specific gravity of wood. U.S. Dep. Agr. Tech. Bull. 1288, 97 pp., illus.

A table relates specific gravity to rings per inch. Data show that the best Sitka spruce from the standpoint of strength has a growth rate of 11 rings or more per inch.

1240. Paul, Frances.
1954. Spruce root basketry of the Alaska Tlingit. U.S. Dep. Int. Bur. Indian Aff. Indian Handcrafts 8, 80 pp., illus.

1241. Pawsey, R. G., and Gladman, R. J.
1965. Decay in standing conifers developing from extraction damage. Great Brit. Forest. Comm. Forest Rec. 54, 25 pp., illus.

1242. Peace, T. R.
1954. The control and avoidance of forest tree diseases. *In* Report on forest research for the year ended March 1953. Great Brit. Forest. Comm., pp. 62-70, illus. London: H. M. Stationery Office.

1243. _______
1962. Pathology of trees and shrubs with special reference to Britain. 753 pp., illus., plus 16 plates. London: Oxford Univ. Press.

The author devotes one chapter to diseases of spruce, including Sitka spruce (Chapter 23, pp. 307-317).

1244. _______ and Loughborough, H. L.
1949. Dying of groups of Sitka spruce. J. Forest. Comm. 20: 201-202.

1245. Pearson, F. G. O.
1963. Home-grown timber for cable drum manufacture. Timber Trades J. Annu. Spec. Issue, pp. 141-142, illus.

Includes data on the grades and dimensions of timber sawn from thinnings of 6-inch minimum top diameter. Species include Sitka spruce. Suitability for cable drum manufacture and condition after 2 years' service are discussed.

1246. Peattie, Donald Culross.
1953. A natural history of western trees. 751 pp., illus. Boston: Houghton Mifflin Co.

1247. Peavy, George W.
1929. Oregon's commercial forests. Oreg. State Board Forest. Bull. 2, 94 pp., illus.

1248. Peck, Edward C.
1933. Specific gravity and related properties of softwood lumber. U.S. Dep. Agr. Tech. Bull. 343, 24 pp., illus.

1249. ________
1957. Bending solid wood to form. U.S. Dep. Agr. Handbook 125, 37 pp., illus.

Endwise-compressibility values are given for 12 woods including Sitka spruce. The low value for Sitka spruce indicates that it is unsuited for bending.

1250. Peck, Morton E.
1919. Study of a section of the Oregon coast flora. Iowa Acad. Sci. Proc. 26: 337-362.

Covers the area from Yaquina Head to Yachats River.

1251. ________
1920. The vegetation of Cape Blanco. Iowa Acad. Sci. Proc. 27: 85-89.

1252. Peck, Morton Eaton.
1961. A manual of the higher plants of Oregon. Ed. 2, 936 pp., illus. Binfords & Mort.

1253. Penhallow, D. P.
1896. The generic characters of the North American Taxaceae and Coniferae. Roy. Soc. Can. Proc. and Trans. ser. 2, vol. 2, sect. 5, pp. 33-57, illus.

1254. ________
1907. A manual of the North American gymnosperms, exclusive of the Cycadales but together with certain exotic species. 374 pp. plus 55 plates. Boston: Ginn & Co., the Athenaeum Press.

1255. Perry, R. S.
1941. Sitka spruce. Emp. Forest. J. 20: 171-173.

Deals briefly with the natural distribution of Sitka spruce, the valuable properties and characteristics of its wood, and its many uses.

1256. Peters, William Harrison.
1936. In the forests of the Olympics. Amer. Forests 42(4): 170-176.

Describes the forest in the central range of the Olympic Mountains including Sitka spruce.

1257. Petersen, B. Beier.
1952. *Hylesinus micans* artens udbredelse og en oversigt over dens optraeden i Danmark. [*Dendroctonus micans*, its geographical distribution and a survey of its occurrence in Denmark.] Dansk Skovforen. Tidsskr. 37(6): 299-322, illus. [In Danish. English summary.]

1258. Petersen, Broder Beier.
1955. Hylobius-bekaempelse: forsøg med DDT, parathion og blyarsenat. [Control of *Hylobius* (*abietis*): Trials with DDT, parathion and Pb arsenate.] Dansk Skovforen. Tidsskr. 40(5): 200-215, illus. [In Danish. English summary.]

In field experiments, spraying young spruce with solutions containing 1 percent active DDT or 0.2 percent active parathion, or dipping the plants (top and roots, or top only) in DDT, gave good control.

1259. Peterson, C. A., and Cowling, E. G.
1963. Resistance of extractive-free coniferous woods to decay by white-rot fungi. (Abstr.) Phytopathology 53(3): 351.

No significant decrease in resistance to decay by *Polyporus* (*Polystictus*) *versicolor* and *P. anceps* resulted from extraction of wafers of Sitka spruce heartwood with ether, acetone, a one-half mixture (by volume) of ethanol/C_6H_6 and water, or with each of these solvents, successively in order of increasing polarity. Water extraction increased decay resistance. Impregnation of water-extracted wafers with solutions of 1 percent urea, 1 percent glucose, or both, decreased resistance, suggesting that water extraction had removed readily available nutrient materials essential to decay.

1260. Peterson, Roger S.
1964. Diseases of *Picea* (other than *P. abies*). *In* Diseases of widely planted forest trees, by Working Group on International Cooperation in Forest Disease Research, Section 24, Forest Protection, International Union of Forestry Research Organizations, pp. 38-51. FAO/IUFRO Symp. Int. Dangerous Forest Dis. & Insects (Oxford) July 20-30, 1964.

1261. Petrie, S. M., and MacKay, A.
1948. Seed-beds and the heat wave. Scot. Forest. 1(3/4): 30-31.

Seed sown in Argyll in the last week of May 1946 made normal growth until the beginning of August. About mid-August it was noted that seedlings were turning brown and then breaking off at the soil surface. It was concluded that the damage was due to heat; the crystalline particles of grit covering the beds, having been raised to a very high temperature, scorched the seedling stems. The severity of damage to species was in the following order: Japanese larch, Sitka spruce, Scots pine, Norway spruce, Douglas-fir.

1262. Phillips, D. H.
1964. Forest pathology. *In* Report on forest research for the year ended March 1963. Great Brit. Forest. Comm., pp. 56-60. London: H. M. Stationery Office.

Describes heavy infection of Sitka spruce seedlings in a nursery by gray mold (*Botrytis cinerea*).

1263. Phillips, E. W. J.
1941. The inclination of the fibrils in the cell wall and its relation to the compression strength of timber. Emp. Forest. J. 20: 74-78.

As part of an investigation into the relation between anatomical structure and the maximum crushing strength of British-grown Sitka spruce, the influence of the degree of inclination of the spirally arranged fibrils of the middle layer in the secondary tracheid wall was examined. A satisfactory method of determining the fibril angle from the slope of the ray pit apertures is described. The normal variation in fibril angle within the tree was determined and the causes of this are discussed.

1264. _______
1948. Identification of softwoods by their microscopic structure. Forest Prod. Res. Lab. Bull. 22, 56 pp., illus. (Reprinted 1963.)

1265. _______
1963. Timber improvement by tree selection and breeding. World Consultation Forest Genetics Tree Improvement Proc. (Stockholm), Sect. 7, pp. 1-5.

Describes methods developed for the study of timber features in plus trees of British-grown Sitka spruce, with special reference to density, fiber length, and spiral grain.

1266. _______, Adams, E. H., and Hearmon, R. F. S.
1962. The measurement of density variation within the growth rings in thin sections of wood, using Beta particles. J. Inst. Wood Sci. (London) 10, pp. 11-28, illus.

Discusses the development of a method using β-particles from C^{14}.

1267. _______ and Patterson, D. G.
1965. Two-stage windthrow in Sitka spruce. Quart. J. Forest. 59(4): 322-326, illus.

Investigation of brittle windthrow fractures following an easterly gale in a stand of Sitka spruce growing on a Devonshire hillside showed that the stems had broken off at compression failures induced by a westerly gale 2 years earlier, following the cutting of a roadway, which increased the exposure. The "first stage" damage had become protected by wound tissue and rapidly developed compression wood, giving rise to well-marked stem swellings which presumably saved some stems from second and final damage when the rest were broken. The term "compression swelling" is suggested for this defect. (Authors' summary.)

1268. Pillai, Ambuja.
1964. Root apical organization in gymnosperms--some conifers. Torrey Bot. Club Bull. 91(1): 1-13, illus.

Describes the root apical organization of several conifers, including Sitka spruce.

1269. Pillow, Maxon Y.
1949. Studies of compression failures and then detection in ladder rails. USDA Forest Serv., Forest Prod. Lab. Rep. D-1733, 10 pp. plus photos.

Includes Sitka spruce.

1270. Pillsbury, R. W.
1962. The wet coastal forest of British Columbia. (Abstr.) Ecol. Soc. Amer. Bull. 43(3): 54.

1271. Pinchin, R. D.
1951. Nursery extension experiments at Radnor Forest. *In* Report on forest research for the year ended March 1950. Great Brit. Forest. Comm., pp. 24-27. London: H. M. Stationery Office.

Summarizes the followup, in the forest, of experiments made in 1921-27 to test the effects of different densities and methods of sowing seed and grading of seedlings and transplants, for Douglas-fir, Norway and Sitka spruce, and European larch. Results were mainly negative, except that grading of transplants (unlike grading of seedlings at time of lining out) into good plants and culls gave positive results: The mean height for all good plants at the end of the eighth growing season was 60.6 inches compared with 48 inches for the culls.

1272. Pinchot, Gifford.
1907. Sitka spruce. U.S. Dep. Agr. Forest Serv. Silvical Leafl. 6, 4 pp.

1273. Piper, Charles V.
1906. Flora of the State of Washington. U.S. Nat. Herb. Contrib., vol. 11, 637 pp., illus.

1274. _______ and Beattie, R. Kent.
1915. Flora of the northwest coast; including the area west of the summit of the Cascade Mountains, from the forty-ninth parallel south to the Calapooya Mountains on the south border of Lane County, Oregon. 418 pp. Lancaster, Pa.: New Era Printing Co.

1275. Place, I. C. M.
1950. The identification of spruce seedlings. Can. Forest. Br. Silvicult. Leafl. 40, 2 pp., illus.

The margins of the juvenile needles of red, black, and Sitka spruce are smooth, whereas those of white and Norway spruce are usually serrulate with fine teeth on each of the four corners of the needle.

1276. Platt, Rutherford.
1952. American trees; a book of discovery. 256 pp., illus. New York: Dodd, Mead & Co.

1277. Platt, Rutherford Hayes.
1965. The great American forest. 271 pp., illus. Englewood Cliffs, N. J.: Prentice-Hall.

1278. Plummer, Fred G.
1900. Mount Rainier Forest Reserve, Washington. In Twenty-first annual report 1899-1900, part 5, Forest Reserves. U.S. Geol. Surv., pp. 81-143, illus.

1279. Polge, Hubert.
1963. Contribution a l'étude de la qualité du bois des principales essences resineuses exotiques utilisee dans les reboisements Français. [The quality of wood of the principal exotic conifers used in French plantations.] Ann. de L'Ecole Nat. Des Eaux et Forêts 20(3): 401-469 plus 2 plates. [In French.]

A study of the physical, mechanical, and working properties of samples, from the Royal Arboretum, of several conifers, including Sitka spruce.

1280. Pomeroy, Kenneth B., and Dixon, Dorothy.
1966. These are the champs. Amer. Forests 72(5): 14-35, illus.

Lists the largest known Sitka spruce in the United States: located in Olympic National Park, Wash., it is 41 feet, 8 inches in circumference and 214 feet high, and has a 50-foot spread.

1281. _______ and Littlecott, Lorna C.
1967. The social register - 85 new champs. Amer. Forests 73(9): 28-33, illus.

The largest Sitka spruce recorded (as of 1967) is the "Helen Clapp Spruce," located near Forks, Wash. Circumference at breast height, 56.2 feet; height, 248 feet; spread, 88 feet.

1282. Prax, J. L., and Parde, J.
1964. Les resineux dans le nord- ouest de L'Herault. [Conifers in the northwest of Herault.] Rev. Forest Franc. 16(4): 286-301. [In French.]

Notes on sample plots of several exotics from western North America, including Sitka spruce.

1283. Prentice, R. M. (Compiler).
1962. Forest lepidoptera of Canada, recorded by the forest insect survey. Vol. 2. Nycteolidae, Notodontidae, Nodtuidae, Liparidae. Can. Dep. Forest., Forest Entomol. Pathol. Br. Bull. 128: 77-281, illus.

Includes available data on distribution, feeding type, relative abundance, and seasonal occurrence of insects attacking Sitka spruce.

1284. _______
1963. Forest lepidoptera of Canada, recorded by the forest insect survey. Vol. 3. Lasiocampidae, Thyatiridae, Drepanidae, Geometridae. Can. Dep. Forest., Forest Entomol. Pathol. Br. Pub. 1013: 282-543, illus.

1285. ______
1965. Forest lepidoptera of Canada, recorded by the forest insect survey. Vol. 4. Microlepidoptera. Can. Dep. Forest., Forest Entomol. Pathol. Br. Pub. 1142: 543-840, illus.

1286. Preston, Richard J., Jr.
1961. North American trees (exclusive of Mexico and tropical United States). Ed. 2, 395 pp., illus. Ames: Iowa State Univ. Press.

1287. Puchert, H.
1956. Die Sitka-fichte im ehemaligen land Braunschweig. [Sitka spruce in the former province of Brunswick.] Allg. Forstzeitschrift 45/46: 577-581. [In German.]

1288. Pyatt, D. G.
1966. The soil and windthrow survey of Newcastleton Forest, Roxburghshire. *In* Report on forest research for the year ended March 1965. Great Brit. Forest. Comm., pp. 204-206. London: H. M. Stationery Office.

1289. ______
1967. Planning and economics. *In* Report on forest research for the year ended March 1966. Great Brit. Forest. Comm., p. 79. London: H. M. Stationery Office.

1290. ______
1967. Soil survey for forestry purposes in upland Wales. Welsh Soils Discuss. Group Rep., pp. 110-119.

Freely drained brown earths and ochreous brown earths are suitable for Sitka spruce. Alluvial soil and mineral gley appear better for Norway than for Sitka spruce. Sitka is more suitable than Norway on ironpan soils, transition soils between ochreous and ironpan, and shallow and deep peaty gley soils, these being too exposed for Norway spruce. Except for deep peats, Sitka is preferred for most land over 1,000-foot elevation.

1291. Querengässer, F.
1953-54. Die grüne Douglasie (*Pseudotsuga taxifolia*, Douglas-fir, red fir) und ihre begleitholzarten. [The green Douglas-fir and its associated trees.] Deut. Dendrol. Ges. Mitt. 58: 127-141. [In German.]

1292. ______
1956. Was ist beim Anbau der Douglasie und Sitka-fichte zu berucksichtigen? [What is to be considered in the cultivation of Douglas-fir and Sitka spruce?] Allg. Forstzeitschrift 45/46: 586-589. [In German.]

1293. Raabe, Robert D.
1962. Host list of the root rot fungus, *Armillaria mellea*. Hilgardia 33(2): 25-88.

Host list includes Sitka spruce in England, Eire, Denmark, and the United States (Washington State).

1294. Radcliffe, Byron M.
1965. A theoretical evaluation of Hankinson's formula for modulus of elasticity of wood at an angle to the grain. Mich. Agr. Exp. Sta. Quart. Bull. 48(2): 286-295, illus.

1295. Radu, St.
1962. Duglasul, molidul de Sitka si alte specii in Ocolul silvic Anina. [Douglas-fir, Sitka spruce and some other species in the Anina Forest Region, Rumania.] Padurilor Rev. 77(2): 80-83, illus. [In Rumanian. English summary.]

Gives mean height and d.b.h. from experimental plantations, 43 to 63 years old, of *Pseudotsuga taxifolia, Abies balsamea, Picea glauca,* and *P. sitchensis,* with *P. abies, Larix decidua, Pinus sylvestris, Abies alba,* and *Fagus sylvatica* for purposes of comparison.

1296. Ragnarsson, H.
1964. Trjaskemmdir vorid 1963. [Damage to trees in spring 1963.] Ársrit Skógraektarf. Islands 1964: 25-27. [In Icelandic.]

Sitka spruce was particularly affected by a severe frost in early April after a long cold spell.

1297. Ram Reddy, M. A., and Last, F. T.
1961. Sitka seedling diseases. Rothamsted [England] Exp. Sta. Rep. 1960: 127-128.

1298. _______ and Last, F. T.
1962. Sitka seedling diseases. Rothamsted (England) Exp. Sta. Rep. 1961: 119.

Soils from five Forestry Commission nurseries were analyzed by a modified dilution-plate method, and fungus populations were compared. The two groups of fungi most often isolated from diseased Sitka spruce seedlings were rarely isolated from soil. *Cylindrocarpon radicicola* was the fungus most frequently isolated at Kennington Old and Ringwood nurseries; next was a group of *Pythium* spp. (*P. ultimum, P. irregulare,* and two new species).

1299. _______, Salt, G. A., and Last, F. T.
1964. Growth of *Picea sitchensis* in old forest nurseries. Ann. Appl. Biol. 54(3): 397-414 plus 1 plate, 2 figs., 24 graphs, 8 tables.

Partial sterilization of nursery soil reduced seedling losses attributed mainly to invasion by *Pythium* spp.

1300. Randall, Warren R.
1965. Manual of Oregon trees and shrubs. 234 pp., illus. Corvallis: Oregon State Univ. Book Stores.

1301. Rankin, W. H.
1918. Manual of tree diseases. 398 pp., illus. New York: Macmillan Co.

1302. Rapraeger, Harold A.
1952. Total height volume tables for western hemlock, Sitka spruce, and young growth Douglas-fir (based on 32-foot logs and on an

8-inch top). USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Res. Note 82, 6 pp.

Tables were developed by adjusting tree volumes in existing tables, a large sample of measured trees of each of the three species being analyzed to provide adjustment factors.

1303. Rasmussen, Axel.
1961. Hansted byplantage. [Hansted town plantations.] Dansk Skovforen. Tidsskr. 46(5): 208-224, illus. [In Danish.]

Discusses planting since 1950, aimed at providing shelter for the town and harbor in a district of northwest Jutland very much exposed to wind, where the soil is a moraine layer overlying limestone and covered by various depths of blown sand. Includes notes on the early development of various species tried, including Sitka spruce.

1304. Rasmussen, Edmund F.
1961. Dry kiln operators manual. U.S. Dep. Agr. Handbook 188, 197 pp., illus.

Gives detailed information on construction and operation of dry kilns. Proper control of drying conditions and handling of lumber are stressed. Drying schedules are given for many woods including Sitka spruce. Tabular values are given for specific gravity, electrical resistance, moisture content, and shrinkage.

1305. Rave, D.
1951. Zu den Untersuchungsergebnissen über die Sitka des Herrn Dr. Friedrich. [Results of Dr. Friedrich's researches on Sitka spruce.] Forst- und Holz. 6(3): 38-39. [In German.]

Author concludes that the high yields obtained from Sitka spruce in Germany outweigh the danger of loss from *Fomes annosus* attack.

1306. Rayner, M. C., and Levisohn, I.
1941. The mycorrhizal habit in relation to forestry. IV. Studies on mycorrhizal response in *Pinus* and other conifers. Forestry 15: 1-36.

Describes mycorrhizal and pseudomycorrhizal association in a number of conifers, observed during 10 years' intensive study of experimental sowings and plantings in an afforestation area in southwestern England. The species receiving special attention include Sitka spruce.

1307. Record, Samuel J.
1919. Identification of the economic woods of the United States; including a discussion of the structural and physical properties of wood. Ed. 2 (rev. and enlarged), 157 pp. plus 6 plates. New York: John Wiley & Sons; and London: Chapman & Hall, Ltd.

1308. ________
1934. Identification of the timbers of temperate North America, including anatomy and certain physical properties of wood. 196 pp., illus. New York: Wiley & Sons.

1309. _______ and Hess, Robert W.
1943. Timbers of the new world. 640 pp., illus. New Haven: Yale Univ. Press.

1310. Rediske, J. H.
1961. Chemical selectivity in woody plants. Hormology 3(2): 7-9.

Describes experiments made at the Weyerhaeuser Forestry Research Center to investigate the selectivity of weedkillers. Results are tabulated, giving comparative effects of different preparations on several tree and brush species including Sitka spruce.

1311. _______ and Johnson, Norman E.
1965. The absorption and translocation of the systemic insecticide Schradan in Sitka spruce and grand fir. Weyerhaeuser Timber Co. Weyerhaeuser Forest. Pap. 5, 9 pp., illus.

Schradan tagged with P^{32} was tested on seedlings grown in nutrient solutions in a controlled-environment chamber. Sixty parts per million Schradan in the nutrient solution was absorbed in greatest amounts in the current foliage after 16 days (3.5 parts per million in spruce) with old foliage, bark, and wood in decreasing order. Schradan applied to terminal buds was shown by autoradiographs to be absorbed and translocated down the main stem and into lateral branches.

1312. Rehder, A.
1949. Manual of cultivated trees and shrubs hardy in North America. Ed. 2 (rev. and enlarged), 996 pp., illus. New York: MacMillan Co.

1313. Rehder, Alfred.
1949. Bibliography of cultivated trees and shrubs hardy in the cooler temperate regions of the northern hemisphere. 825 pp. Jamaica Plain, Mass.: Arnold Arboretum, Harvard Univ.

Gives references to the sources of botanical names, valid names, and synonyms of Sitka spruce. (14 references.)

1314. Reinhold, M.
1953. Englische Ertragstafeln für Japanische Lärche, Douglasie und Sitkafichte. [British yield tables for Japanese larch, Douglas fir, and Sitka spruce.] Forstarchiv 24(11/12): 261-263, illus. [In German.]

Presents Forestry Commission yield tables recalculated in metric units with volume and height curves.

1315. Rendle, B. J.
1952. Strawberry mark in Sitka spruce lumber. *In* Selected government research reports, vol. 8, pp. 1-2, illus. London: H. M. Stationery Office.

Strawberry mark, a defect of Sitka spruce timber, is a reddish-brown patch, up to 1 by 1-1/2 inches in size, running radially through the wood. It is due to abnormal deposits of resin in the ray cells and does not always affect the wood structure, although in some cases the rays are greatly enlarged, thus reducing the strength of the wood. There may also be a slight deviation in grain.

1316. Rennie, P. J.
1951. Physico-chemical properties of forest soils. Imp. Forest. Inst. Rep. (Oxford) 1949/50: 9.

Chemical analysis of moorland soils from Allerston Forest, Yorkshire, has demonstrated a high concentration of nutrients in the surface peat, where Ca, P, and K contents are respectively 10, five, and two times as great as in the subsoil of lower calcareous grit. The leached layer is very deficient in nutrients. The nutrient content of the litter formed by Sitka spruce planted on this soil is much higher where the trees are growing well than where growth is poor--the figures for Ca were respectively 9 milligrams per gram litter and 2 milligrams per gram litter.

1317. _______
1951. Research into the physical and chemical properties of forest soils. *In* Report on forest research for the year ended March 1950. Great Brit. Forest. Comm., pp. 116-118. London: H. M. Stationery Office.

Failures of Sitka spruce on deep-plowed areas were fewer than on screefed plots. On screefed plots failures tended to be more common on areas formerly occupied by *Eriophorum* spp. Earlier flushing occurred on deep-plowed plots.

1318. _______
1953. Research into the physical and chemical properties of forest soils. *In* Report on forest research for the year ended March 1952. Great Brit. Forest. Comm., pp. 108-116. London: H. M. Stationery Office.

1319. _______
1958. Improvement of the timber productivity of heather moor. Quart. J. Forest. 52: 36-40, illus.

Three planting regimes--Sitka spruce, Sessile oak, and unplanted control--each with and without limestone, are combined factorially with three methods of cultivation. Early results show that on ploughed moor, limestone improves the growth of spruce and materially alters the moor vegetation by drastically increasing grasses at the expense of heather. (From author's summary.)

1320. Rheinheimer, G.
1961. Folgeschaden des extremen Sommers 1959 in den Wäldern der Länder Schleswig-Holstein und Hamburg. [Damage resulting from the extreme summer of 1959 in the forests of the Schleswig-Holstein and Hamburg regions.] Forstarchiv 32(4): 65-73, illus. [In German.]

First losses in 1959 were in new plantations, but by July mature plantations and pole crops had suffered serious loss. In spring 1960 serious damage was visible in mature stands of Norway and Sitka spruce, and in the southeast of the region, in beech also. Heavy salvage fellings were necessary in places. The greatest losses occurred on mineral soil of high organic content where the water table had sunk sharply, and on dune sand, where damage on stand margins was considerable, particularly near the coast. Increased numbers of insect pests were observed in 1960. The causes of the damage were complex, depending much more on soil condition, site, and stand situation than on absolute temperature and amount of rainfall.

1321. Rhoads, Arthur S., Hedgcock, George G., Ellsworth, Bethel, and Hartley, Carl.
1918. Host relationships of the North American rusts, other than Gymnosporangiums, which attack conifers. Phytopathology 8(7): 309-352.

1322. Ricard, Louis.
1956. Un essai de plantation resineuse dans une tourbiere. [An experiment in planting conifers on a peat bog.] Rev. Forest Franc. 8(2): 102-107. [In French.]

Describes an adaptation of the planting methods developed by the United Kingdom Forestry Commission. Sitka spruce was planted along the edge of shallow drainage ditches. The upturned turfs (1 meter square) are lifted by hand, a seedling placed between them, and a third turf propped against the other two on the side away from the ditch. This results in a 3-meter spacing, and preliminary indications promise good survival and growth.

1323. Richards, E. G.
1957. Extractives from wood and bark. *In* Report on forest research for the year ended March 1957. Great Brit. Forest. Comm., p. 82. London: H. M. Stationery Office.

1324. ______
1957. Seasoning in the forest. *In* Report on forest research for the year ended March 1957. Great Brit. Forest. Comm., p. 83. London: H. M. Stationery Office.

1325. ______
1957. Utilization development. *In* Report on forest research for the year ended March 1957. Great Brit. Forest. Comm., pp. 91-94, illus. London: H. M. Stationery Office.

1326. Richardson, S. D.
1959. The effect of night temperature on tracheid size and wood density in conifers. Int. Ass. Wood Anat. News Bull. 2: 4.

Consists of an abstract of a paper prepared for the International Botanical Congress, Montreal. In seedlings of Douglas-fir, *Sequoia sempervirens*, and Sitka spruce grown under a range of different day and night temperatures, in a controlled environment, wood density and cell-wall thickness increased as temperature increased, but showed no consistent relation with day temperature or growth rate. Tracheid length increased as temperature increased, night or day. It is suggested that cell elongation is a relatively direct function of temperature, whereas cell-wall thickness is determined by net assimilation rate. A hypothesis based on observed changes in net assimilation rate with age is proposed to account for differences in density between so-called juvenile and adult wood.

1327. _______
1964. Studies on the physiology of xylem development. III: Effects of temperature, defoliation, and stem girdling on tracheid size in conifer seedlings. J. Inst. Wood Sci. 12, 3-11, illus.

It is concluded that tracheid length is influenced by temperature both directly and indirectly; but that increases in cell length associated with increasing light intensity are not explainable in terms of carbohydrate accumulation. The major determinants of lumen diameter are probably hormonal, but temperature can act directly within this framework. Cell-wall thickness is, to a large degree, influenced by carbohydrate availability but hormonal factors may also operate. (From author's summary.)

1328. _______ and Dinwoodie, J. M.
1960. Studies on the physiology of xylem development. I: The effect of night temperature on tracheid size and wood density in conifers. J. Inst. Wood Sci. 6, 3-13, illus.

1329. Richens, R. H.
1945. Forest tree breeding and genetics. Joint Pub. 8. Imp. Agr. Bur. [Penglais, Aberystwyth, Great Britain], 79 pp.

Contains a bibliography of literature on forest tree breeding from 1930 to 1945.

1330. Rieger, S., and DeMent, J. A.
1965. Cryorthods of the Cook Inlet-Susitna lowland, Alaska. Soil Sci. Soc. Amer. Proc. 29(4): 448-453.

In the vicinity of Kachemak Bay at the southern end of the study area, Sitka spruce is the dominant tree. Physical and chemical properties of cryorthods (Podzols) are described.

1331. Rieger, Samuel, and Wunderlich, R. Eugene.
1960. Soil survey and vegetation of northeastern Kodiak Island area, Alaska. USDA Soil Conserv. Serv. Soil Surv. Ser. 1956, no. 17, 46 pp., illus., with map in pocket.

1332. Rigg, G. B.
1917. Forest succession and rate of growth in sphagnum bogs. J. Forest. 15: 726-739.

Includes descriptions of forest succession on four bogs containing Sitka spruce, one in the Puget Sound region and three in Alaska.

1333. Rigg, George B.
1925. Some sphagnum bogs of the north Pacific coast of America. Ecology 6(3): 260-278, illus.

1334. _______
1937. Some raised bogs of southeastern Alaska with notes on flat bogs and muskegs. Amer. J. Bot. 24: 194-198.

Sitka spruce is one of five tree species growing on a raised bog near Juneau, Alaska. Development, plant succession, and ecology of this and other bogs in southeast Alaska are discussed.

1335. _______ and Harrar, E. S.
1931. The root systems of trees growing in sphagnum. Amer. J. Bot. 18(6): 391-397, illus.

Describes the character and distribution of conifer roots, including Sitka spruce, growing in bogs whose surface layer is sphagnum peat. Observations in all cases indicate excessive elongation of roots growing in peat soils.

1336. Rindt, Charles A., Woods, John B., Jr., and Schroeder, George H.
1953. Direct seeding of forest lands. *In* Reports of the Pacific Northwest Seeding and Planting Comm. on various recommended reforestation practices and techniques, pp. 21-35. Western Forest. Conserv. Ass., Portland, Oreg.

1337. Rishbeth, John.
1967. Control measures against *Fomes annosus* in Great Britain. Fourteenth IUFRO-Kongress Pap. (Munchen) 9 (sect. 24, no. 5): 299-306.

1338. Rivers, Claude F., and Crooke, Myles.
1962. Virus control of the sawfly (*Neodiprion sertifer* Geoff.). Fifth World Forest. Congr. Proc. (Seattle) 1960, 2 (sect. 3C): 951-952.

Describes small-scale trials in (a) a heavily infested shelterbelt of Scots pine and Sitka spruce, just over 7 feet high, in Norfolk, sprayed in mid-May at the third-instar stage, and (b) a mixed Scots pine-Sitka spruce stand in Scotland, 3 to 15 feet high, sprayed in May at stages from egg to second instar. In (a), thorough wetting with 200,000 polyhedra per milliliter, and in (b) mist-blowing with 1-1/2 gallons per acre containing 500,000 polyhedra per milliliter gave good control. In (a) the disease had spread in the following year to untreated or more lightly treated parts, causing almost complete mortality of sawflies.

1339. Robak, H.
1957. Sambandet mellom daglengden og avslutningen av den arlige vekstperioden hos en del nåletreslag av interesse for vårt skogbruk. [The relation between day length and the end of the annual growth period in some conifers of interest to Norwegian Forestry.] Medd. Vestlandet. Forstl. Forsøkssta. 31: 62. [In Norwegian. English summary.]

To establish a 14-hour photoperiod during the summer, seeds were sown in a "shading box" (illustrated) from which light could be excluded; for comparison, seeds were sown in the open or in similar boxes either (1) uncovered or (2) covered with plexiglass. One-year seedlings of Sitka spruce of provenances from regions with a day length shorter than that in Norway during summer but longer than 14 hours, formed terminal buds earlier than controls. Frost-lifting affected the results, but otherwise the short-day treatment gave better wintering. Further experiments are planned.

1340. Robak, Håkon.
1950. Proveniensproblemet og vekstforedling av skogstraer. [The problem of provenance and tree breeding.] Tidsskr. Skogbruk. 58(9): 236-240. [In Norwegian.]

Concludes that although frost-resistant individuals of Sitka spruce may be found among material from the optimum zone of a southern provenance (State of Washington), these should not be used for tree breeding unless they are superior in vigor to plus trees of more northern provenance that are known to be frost resistant.

1341. ________
1960. Spontaneous and planted forest in west Norway. Vestlandet. Geogr. Stud., Skr. Norges Handelshoyskole, Geografiske Avhandl. 7, pp. 2, 18-34, illus.

Sitka spruce is the most important western North American tree species planted in west Norway. Experience with the species is discussed.

1342. ________
1962. Overvintringen av en-og to-årig Sitkagran i planteskolene. [Overwintering of 1- and 2-year Sitka spruce in nurseries.] Arsskr. Norske Skogplantesk. 1961: 35-59 plus 1 table. [In Norwegian. English summary.]

1343. Robinson, Sir Roy L.
1931. Use of Sitka spruce in British afforestation. Forestry 5: 93-95.

Selection of Sitka spruce for afforestation operations in Britain has grown steadily for the 12 years prior to 1931. Sitka spruce is considered to be a maritime tree which finds maritime conditions in Britain.

1344. Rochester, G. H.
1933. The mechanical properties of Canadian woods, together with their related physical properties. Can. Dep. Int. Forest Serv. Bull. 82, 88 pp., illus.

1345. Roff, J. W., and Eades, H. W.
1959. Deterioration of logging residue on the British Columbia coast (western hemlock, amabilis fir, and Sitka spruce). Can. Forest. Prod. Lab. Tech. Note 11, 38 pp., illus.

During the first 3 years, decay losses amounted to over half the net volume: Sitka spruce was more, and amabilis fir less resistant than western hemlock. In western hemlock, decay was mainly of the brown cubical rot type, in Sitka spruce white rot was more prevalent, and in amabilis fir both types were about equal in importance. Deterioration of residue was affected by retention of bark and position of pieces relative to the ground, the occurrence of ambrosia-beetle infestations and of decays which originated in the standing tree and also by the length of material and the solar exposure. (From authors' summary.)

1346. Rogers, George W.
1960. Alaska in transition: the southeast region. 384 pp., illus. Baltimore: Johns Hopkins Press.

1347. Rogers, Ian Henry.
1967. Wood extractives: The structure and chemistry of some triterpenes isolated from the bark of Sitka spruce (*Picea sitchensis*). (Ph.D. thesis on file at Univ. Brit. Columbia.) Diss. Abstr.28: 3228B.

1348. Rohde, Th. von.
1936. Eine neue Krankheit der Sitkafichte in Deutschland. [A new disease of the Sitka spruce in Germany.] Z. Pflanzenkrankh. 46(6): 277-284, illus. [In German.]

1349. Ross, Charles R.
1966. Trees to know in Oregon. (Rev.) Oreg. State Coll. Ext. Serv. Bull. 697, 96 pp., illus.

1350. Ross, J. D.
1956. Chemical resistance of western woods. Forest Prod. J. 6: 34-37.

1351. Roth, Filibert.
1895. Timber: an elementary discussion of the characteristics and properties of wood. U.S. Dep. Agr. Bull. 10, 88 pp., illus.

1352. Rothamsted Experiment Station.
1960. Sitka seedling diseases. Rothamsted [England] Exp. Sta. Rep. 1959: 107-108.

The development of micro-organisms on roots of Sitka spruce seedlings taken from the nursery (started in 1925) at Kennington, near Oxford, was examined through the growing season. Three distinct diseases occurred: (1) there was preemergence and immediate postemergence damping-off; (2) at midsummer there was a sudden browning of the plants; (3) during early autumn the plants became stunted but with no discoloration. Seedling emergence on treated and untreated plots and probable pathogens are discussed.

1353. Rouse, G. D.
1948. Frost damage and recovery in Sitka spruce in the New Forest, Hampshire. Forestry 22(1): 62-63 plus 5 photos.

A plantation formed in 1921 was damaged by late spring frosts in 1927, 1928, and 1929. Investigations in 1947 showed that loss of leader did not necessarily result in a seriously deformed tree. Faster growing trees were quickest to recover.

1354. Roussel, L.
1965. Indications provisoires sur les exigences en lumière de 12 essences forestieres resineuses. [Provisional indications of the light requirements of 12 coniferous forest species.] Soc. Forest. de Franche-Comte Bull. 33(5): 139-150, illus. [In French.]

Describes experiments designed to study light requirements of 12 conifer seedlings including Sitka spruce.

1355. Rowan, A. A.
1963. High pruning. Quart. J. Forest. 57(4): 320-327, illus.

Discusses the silvicultural implications of high pruning, particularly the need to thin so as to favor the pruned stems and achieve the maximum production of clean timber.

1356. _______
1967. Work study in the improvement of timber harvesting efficiency. Forest. Comm. Res. Develop. Pap. 59, 23 pp., illus.

Contains provisional standard time tables per pole for thinning, cross-cutting to Scottish pulpwood specifications, and hand-piling of Sitka spruce pulpwood.

1357. Rowe, J. S.
1959. Forest regions of Canada. Can. Dep. North. Aff. & Natur. Resources Forest. Br. Bull. 123, 71 pp., illus. (Rev. of Bull. 89, 1937.)

1358. Rudloff, E. von.
1964. Gas-liquid chromatography of terpenes. Part X. The volatile oils of the leaves of Sitka and Engelmann spruce. Can. J. Chem. 42: 1057-1062, illus.

1359. Rudnicki, J. M.
1951. Timber fasteners. *In* Canadian woods; their properties and uses. Ed. 2. Can. Forest. Br. Forest Prod. Lab. Div., pp. 305-320, illus.

1360. Rudolph, Emanuel D.
1966. Ecological succession: A summary. *In* Soil development and ecological succession in a deglaciated area of Muir Inlet, southeast Alaska. Inst. Polar Stud. Rep. 20, part 9, pp. 163-165 plus 2 tables.

Describes interrelationships that link soil development, plant succession and invasion, and population by various animals following recent deglaciation.

1361. Rühm, W.
1958. Zur mechanisch-chemischen und ökologischen Bekämpfung des Riesenbastkafers *Dendroctonus micans*. [Mechanical-chemical and ecological control of *D. micans*.] Z. Angew. Entomol. Rep. 43(3): 286-325. [In German. English summary.]

Discusses the reasons (drought, game damage, smoke injury, etc.) for the dangerous increase of this pest in Schleswig-Holstein, chiefly on Sitka spruce, and control measures successfully tried in two forests in Flensburg.

1362. _______
1959. Nematoden und Forstpflanzen. I. Mitteilung. Zur Bodenentseuchung in Forstbaumschulen und Forstkamps. [Nematodes and forest plants. I. Soil disinfestation in forest nurseries.] Merck-Blätter, Rep. Darmstadt 9(3): 1-16. [In German.]

Discusses the role of nematodes as a factor in "soil sickness" in nurseries, with special reference to conifers. A list of parasitic nematodes identified on conifers in Germany, the United States, and the Netherlands is given. In the conifer nurseries investigated, usually 20 percent of all nematode species present were parasitic, but the numerical density of parasitic species was often very great. *Rotylenchus robustus* was one of the most abundant. Sitka spruce appeared to be a highly susceptible species.

1363. Russell, Kenelm W.
1965. Conifer freeze damage 1964/65, Snohomish County, Washington. Wash. State Dep. Natur. Resources Res. Manage. Rep. 11, 8 pp.

1364. Ruth, Robert H.
1950. Cutting plans on logging costs in a 100-year-old stand of Sitka spruce and western hemlock. 118 pp. (M.F. thesis on file at Oreg. State Coll., Corvallis.)

1365. ________
1956. Plantation survival and growth in two brush-threat areas in coastal Oregon. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Res. Pap. 17, 14 pp., illus.

In spring 1949, conifer plantations were established on a 44-acre site of Douglas-fir and an 81-acre site of Sitka spruce-western hemlock that had been clearcut 1 to 2 years earlier. Examinations over a 5-year period showed that competition with red alder, salmonberry (*Rubus spectabilis*), and associated shrubs was severe; only 37 percent of the planted Douglas-fir and about 25 percent of the planted spruce and hemlock survived. Recommendations are broadcast burning and early planting with large stock, plus chemical brush control as needed.

1366. ________
1957. Ten-year history of an Oregon coastal plantation. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Res. Pap. 21, 15 pp., illus.

In a comparison of 10-year survival and growth, Douglas-fir survived better and grew faster than either Sitka spruce or Port-Orford-cedar. Effects of competing vegetation, animal damage, and aspect are reported and discussed.

1367. ________
1958. Silvical characteristics of Sitka spruce. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Silvical Ser. 8, 19 pp., illus.

Summarizes information on the silvics of Sitka spruce including its relationship to climate, soils, topography, and associated species. Includes a description of its life history from seedling stage to maturity.

1368. ________
1965. Silviculture of the coastal Sitka spruce-western hemlock type. Soc. Amer. Forest. Proc. 1964: 32-36, illus.

Briefly describes the silvics of Sitka spruce and western hemlock, describes the coastal spruce-hemlock forest type, and summarizes current silvicultural practices.

1369. ________
1967. Silvicultural effects of skyline crane and high-lead yarding. J. Forest. 65: 251-255, illus.

Skyline crane yarding 77,000 board feet of logs per acre from steep slopes in the Sitka spruce-western hemlock type in coastal Oregon exposed 6.4 percent of the mineral soil, compared with 15.8 percent by conventional high-lead yarding. Differences were not statistically significant. Skidtrails tended to be across the slope, in contrast to high-lead skidtrails, which were mostly up and down slope. Damage to established tree seedlings and lesser vegetation was about the same for the two systems. The skyline crane system requires much less road construction than conventional systems, reducing construction costs as well as soil disturbance and land area taken out of production.

1370. _______ and Berntsen, Carl M.
1955. A 4-year record of Sitka spruce and western hemlock seedfall on the Cascade Head Experimental Forest. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Res. Pap. 12, 13 pp., illus.

Six clearcut areas, ranging from 15 to 81 acres, received adequate seed from surrounding stands throughout their area. Seedfall started in the last 10 days of October and tapered off gradually until April and May. Western hemlock produced more seed than Sitka spruce. Seedfall under dense 100-year spruce-hemlock stands was 15 times that on clearcut areas. Viability of seed from the two species averaged 55 percent.

1371. _______ and Berntsen, Carl M.
1956. Chemical basal treatment to control red alder. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Res. Note 128, 6 pp., illus.

Red alder often overtops conifer seedlings, including Sitka spruce, on certain sites in the Oregon Coast Ranges. Foliage spraying from the air is recommended for control on large areas, but on smaller areas basal treatment is best--especially for trees over 15 feet tall. Three solutions of 2,4-D or 2,4,5-T were used, and each proved successful. Results are tabulated. Chemical control cost about as much as hand girdling but had the advantage of preventing root sprouting.

1372. _______ and Silen, Roy R.
1950. Suggestions for getting more forestry in the logging plan. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Res. Note 72, 15 pp.

Presents and discusses techniques and principles for preparation of intensive forestry-logging plans for the Sitka spruce-western hemlock and Douglas-fir forest types.

1373. _______ and Yoder, Ray A.
1953. Reducing wind damage in the forests of the Oregon Coast Range. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Res. Pap. 7, 30 pp., illus.

Storm winds causing windthrow came from the S.S.W. On the borders of clearcut areas, 93 percent of the wind damage occurred along the north and east boundaries, especially when these boundaries were on the leeward side of a ridge. No correlation was found between wind damage and size of cutting, but areas less than 2 acres sustained considerable loss. In stands from which 16 to 24 percent of the volume had been removed in thinnings, losses from windthrow averaged 80 board feet per acre per year, while losses were heavy in other areas from which most of the dominant and codominant trees had been removed. Douglas-fir and Sitka spruce were more windfirm than western hemlock, and trees infected with root rot were particularly liable to windthrow. Windthrow is more severe on areas with a high watertable or very shallow soil. In virgin stands heaviest damage occurred on the lee side of ridges, beginning near the crest of the ridge and extending for some distance down the lee slope, and also on small ridges and level areas in the lee of higher ridges. Recommendations are made on cutting practices to reduce windthrow.

1374. Ruth, Robert Harvey.
1967. Differential effect of solar radiation on seedling establishment under a forest stand. 176 pp., illus. (Ph.D. thesis on file at Oreg. State Univ., Corvallis.)

Sitka spruce, western hemlock, and Douglas-fir seedlings all became established more readily on mineral soil under a forest canopy than did red alder. The ratio of viable seed sown in the spring to establish seedlings in the fall was 5.8 for the conifers compared with 46.7 for alder. Radiation had surprisingly little effect on seedling establishment but played an important role in first season growth. Spruce and hemlock growth increased with radiation up to an average daily radiation of about 150 Langleys, then decreased at higher radiation levels. The decrease was attributed to high soil moisture tension.

1375. Rutter, A. J.
1955. The relation between dry weight increases and linear measures of growth in young conifers. Forestry 28(2): 125-135, illus.

Briefly examines a number of measurements of growth and dry weight of young crops of *Pinus sylvestris* and *Picea sitchensis* and concludes that, at any time before the canopy is closed, dry weight is more closely related to basal diameter than to height.

1376. Sabroe, A. S.
1947. Forestry in Denmark: A guide to our guests. Ed. 2, Danish Forest Soc., 114 pp., illus.

Includes a bibliography and who's who in forestry. Entirely in English. Sitka spruce was introduced in Denmark about 1875 and has been planted extensively of late bacause of its vigorous growth and frugality. *Fomes annosus*, however, does more harm to this species than to Norway spruce.

1377. Salt, G. A.
1963. Disease of Sitka spruce seedlings. Rothamsted [England] Exp. Sta. Rep. 1962: 122-123.

The number of seedlings obtained from 1,800 viable seeds per square yard differed greatly between nurseries, when all were sown under ideal conditions in March. Seed treatment with methoxyethyl mercury chloride reduced preemergence loss and increased numbers but had no effect on postemergence damping-off, or on seedling height. Partial soil sterilization with formalin and chloropicrin controlled damping-off and substantially increased heights. Soil and seed treatments together produced the best results.

1378. ________
1964. Diseases of Sitka spruce seedlings in forest nurseries. Rothamsted [England] Exp. Sta. Rep. 1963: 114-116.

Dazomet (Mylone) proved as effective as formalin as a soil sterilant and has the practical advantage of being applied as a dry powder. Of fungi on root debris remaining in seedbeds from one year to the next, *Cylindrocarpon* sp. was most often isolated. Others were *Fusarium* sp. and *Pythium* sp. Although partial sterilants almost eliminated these three genera from debris, the material was colonized by other fungi rare or absent in isolations from untreated material. In tests of pathogenicity of pure cultures, all species of *Pythium* killed most seedlings before emergence. *Cylindrocarpon* and several species of *Fusarium, Phoma,* and *Botrytis* behaved as weak pathogens by decreasing emergence and causing some postemergence deaths.

1379. ________
1964. Pathology experiments on Sitka spruce seedlings. *In* Report on forest research for the year ended March 1963. Great Brit. Forest. Comm., pp. 83-87. London: H. M. Stationery Office.

1380. ________
1965. Pathology experiments on Sitka spruce seedlings. *In* Report on forest research for the year ended March 1964. Great Brit. Forest. Comm., pp. 89-95. London: H. M. Stationery Office.

Describes continuing study of causes of stunting and the nature of growth responses to partial sterilization of soil in old forest nurseries.

1381. ________
1966. Pathology experiments on Sitka spruce seedlings. *In* Report on forest research for the year ended March 1965. Great Brit. Forest. Comm., pp. 97-102. London: H. M. Stationery Office.

1382. ________
1966. Diseases of Sitka spruce seedlings in forest nurseries. Rothamsted [England] Exp. Sta. Rep. 1965: 133-134.

1383. ________
1967. Pathology experiments on Sitka spruce seedlings. *In* Report on forest research for the year ended March 1966. Great Brit. Forest. Comm., pp. 104-108. London: H. M. Stationery Office.

The following fungi isolated from Sitka spruce seed were associated with germination failure and were reisolated consistently from dead seeds or seedlings: *Phizoctonia solani, Cylindrocarpon, Gliocladium roseum,* and unidentified psychrophilic fungus. Losses were greater when seed was incubated at 10° than at 20° or 5° C. and were decreased by treating seed with thiram dust. (From author's summary.)

1384. ________
1967. Pathology experiments on Sitka spruce seedlings. *In* Report on forest research for the year ended March 1967. Great Brit. Forest. Comm., pp. 141-146. London: H. M. Stationery Office.

An endophytic fungus in Sitka spruce seed greatly decreased the viability of dormant seed incubated for 4 weeks at 10° C. in sterilized quartz grit or in unsterilized nursery soil. Seed incubated at 15° C. and 20° C. germinated and escaped serious damage. Infection was prevented and viability maintained at 10° C. by treating seed with a 50-percent thiram dust. Seed from the same bulk as used in the laboratory, when sown in nursery seed beds in 1965 and 1966, mostly survived and germinated, but many seedlings became infected by species of *Pythium*, *Fusarium*, and *Cylindrocarpon* and died soon after they emerged. (Author's summary.)

1385. Sanzen-Baker, R. G., and Nimmo, M.
1941. Glazed frost 1940--damage to forest trees in England and Wales. Forestry 15: 37-54.

Damage to Sitka spruce was often severe but less than damage to larch or Douglas-fir. In both young and middle-aged plantations, dominant trees with large crowns overtopping their neighbors received worst damage, particularly in young stands of Sitka spruce and Douglas-fir.

1386. Sargent, C. S.
1885. The woods of the United States. With an account of their structure, qualities, and uses. With geographical and other notes on the trees which produce them. 203 pp., illus. New York: D. Appleton & Co.

1387. ________
1897. The forests of Alaska. Gard. & Forest 10(501): 379-380.

1388. Sargent, Charles S.
1884. Report on the forest of North America (exclusive of Mexico). U.S. Dep. Int. Census Office. 612 pp., illus.

Briefly describes Sitka spruce and its occurrence in the United States, with information on wood properties.

1389. Sargent, Charles Sprague.
1898. The silva of North America. A description of the trees which grow naturally in North America exclusive of Mexico. Vol. 12 (Coniferae), 144 pp., illus. Boston and New York: Houghton, Mifflin & Co.

Includes a description of the silvical characteristics of Sitka spruce and a line drawing showing foliage, cones, and cone parts.

1390. ________
1933. Manual of the trees of North America (exclusive of Mexico). Ed. 2, 910 pp., illus. Boston and New York: Houghton, Mifflin & Co.

1391. ________
1961. Manual of the trees of North America (exclusive of Mexico). 2d corrected ed., vols. 1 & 2, 910 pp., illus. New York: Dover Publications.

1392. Savile, D. B. O.
1955. Chrysomyxa in North America--additions and corrections. Can. J. Bot. 33: 487-496.

1393. Savory, J. G., and Packman, D. F.
1954. Prevention of decay of wood in boats. With a contribution on electrochemical attack. Great Brit. Dep. Sci. Ind. Res. Forest Prod. Res. Bull. 31, 17 pp. plus 8 plates.

Describes decay of wood in boats and methods of prevention. Sitka spruce is listed as a "nondurable" wood, this grade being given quantitative meaning in that the life of a 2- by 2-inch specimen in the ground is between 5 and 10 years old.

1394. Schaefer, R. J.
1967. Three cheers for the "America." Amer. Forests 73(9): 4-7, 42, illus.

Briefly describes America's cup winner, "America." Sitka spruce was used for deck beams.

1395. Schefer-Immel, Verena.
1958. Einige Bemerkungen zur Biologie und zum Einfluss von Temperatur und rel. Luftfeuchtigkeit auf die Entwicklung von Ei, Raupe und Puppe von *Boarmia bistortata* Goeze (Lepidoptera, Geometridae). [Notes on the biology of *B. bistortata* and the effect of temperature and relative humidity on egg, larva, and pupa.] Z. Angew. Entomol. 42(3): 307-315, illus. [In German. English summary.]

In laboratory experiments the looper moth larvae ate foliage of larch, Sitka spruce, poplars, and lettuce but preferred larch.

1396. Scheffer, T. C., and Browne, F. L.
1954. Tests of some superficial treatments of exposed wood surfaces for their protection against fungus attack. J. Forest Prod. Res. Soc. 4(3): 131-132.

1397. Scheffer, Theodore C., Wilson, T. R. C., Luxford, R. F., and Hartley, Carl.
1941. The effect of certain heart rot fungi on the specific gravity and strength of Sitka spruce and Douglas-fir. U.S. Dep. Agr. Tech. Bull. 779, 24 pp., illus.

The appearance of Sitka spruce wood attacked by *Polyporus schweinitzii* was not a good indication of the degree of decay up to the point where wood broke up into cubical masses. The white pockets that characterize the decay of *Fomes pini* provided a good progress indicator. A 20-percent loss in shock resistance of Sitka spruce when infected with *P. schweinitzii* was found, even when infection could only be detected by microscope or culture.

1398. Scheller, H. D. Von.
1958. Massenvermehrung der Sitkafichtenlaus, *Elatobium* (=*Liosomaphis*) *abietina* WALK in Nordwestdeutschland. [Outbreak of *E. abietina* in northwest Germany.] Anz. Schadlingsk 31(6): 85-88, illus. [In German.]

E. abietina has existed for years in small numbers in Schleswig-Holstein. In 1957, however, favored by weather, a definite outbreak occurred on Sitka spruce. Notes are given on hosts (a number of *Picea* spp.), damage inflicted, and natural enemies. Control measures had undesirable side effects, especially on natural enemies. The best time for dusting is early spring. The pest prefers shade and is found in greatest numbers in dense, poorly thinned stands.

1399. _______
1962-63. Zur Biologie und Schadwirkung der Nadelholzspinnmilbe *Oligonychus ununguis* Jacobi (Acar. Tetr.) und der Fichtenrohrenlaus *Liosomaphis abietina* Walker (Hom. Aphid.). [Biology and injurious effects of *O. ununguis* Jacobi (Acar. Tetr.) and *L. abietina* Walker (Hom. Aphid.).] Z. Angew. Entomol. 51(1): 69-85, illus.; 51(3): 258-284, illus. [In German.]

1400. Schenck, C. A.
1912. The art of the second growth or, American sylviculture. Ed. 3, 206 pp. Albany, New York: The Brandow Printing Co.

1401. Schimitschek, Von Erwin, and Wienke, Elisabeth.
1963. Untersuchungen uber die Befallsbereitschaft von Baumarten fur Sekundarschadlinge. I. [Research studies of susceptibility of conifers to secondary parasites.] Z. Angew. Entomol. 51(3): 219-257. [In German.]

Describes an investigation of the physiological basis for attack of Sitka spruce by *Dendroctonus micans*. Bark anatomy, sap-stream velocity, transpiration, osmotic pressure, and electrical resistance in bark are considered.

1402. Schmidt, R. L.
1957. The silvics and plant geography of the genus *Abies*. Dep. Lands & Forests, Brit. Columbia Tech. Pub. T-46, 31 pp., illus.

Sitka spruce occurs in mixture with *Abies lasiocarpa* at Meziadin Lake, B.C. (latitude 56°).

1403. Schmiege, D. C.
1966. Mortality of overwintering eggs of the black-headed budworm and hemlock sawfly in southeast Alaska. Northern Forest Exp. Sta. USDA Forest Serv. Res. Note NOR-15, 4 pp., illus.

1404. _______ and Hard, J. S.
1966. Oviposition preference of the black-headed budworm and host phenology. Northern Forest Exp. Sta. USDA Forest Serv. Res. Note NOR-16, 5 pp., illus.

Phenology of western hemlock and Sitka spruce shoot growth in relation to budworm hatch and development was studied on two aspects. Shoot growth of both tree species was greater and started earlier on south rather than north aspects. Budworm development followed the same pattern. Peak hatch occurred when hemlock buds began expansion and when spruce shoots had completed about 50 percent of their growth. In preference tests, budworms preferred hemlock for egg laying regardless of species on which they were reared. Budworms may lay eggs on spruce during prolonged outbreaks when hemlock is severely defoliated, but it is likely that fewer of the larvae survive because the rapidly expanding spruce shoots provide less shelter.

1405. Schmiege, Donald C.
1965. The fecundity of the black-headed budworm *Acleris variana* (Fern.) (Lepidoptera: Tortricidae) in coastal Alaska. Can. Entomol. 97: 1226-1230.

The oviposition and fecundity of field- and lab-reared specimens of the black-headed budworm, *Acleris variana* (Fern.), are reported.

1406. Schneider, Von I.
1961. Ein schädliches Auftreten des Fichtenblasenfusses, *Taeniothrips pini* Uz., an Maitrieben der Sitkafichte (*Picea sitchensis* Traut. und Mey.). [An outbreak of *T. pini* on spring shoots of Sitka spruce.] Anz. Schadlingsk 34(9): 135-137, illus. [In German.]

T. pini was found in 1958 in the forest district of Trittau near Hamburg in a 17-year stand of Norway and Sitka spruce. A survey was made in subsequent years of the distribution of the insect near Hamburg and in Schleswig-Holstein, and information is presented on its biology and life history. Damage was negligible except where ornamental branches of Sitka spruce were spoiled.

1407. Schneider, Isolde.
1962. Die Nadelholzspinnmilbe, *Paratetranychus ununguis* Jac. (Acari, Trombidiformes), auf den Aufforstungsflachen Schleswig-Holsteins. [*P. ununguis* Jac. of afforestation areas in Schlesvig-Holstein.] Allg. Forst- und Jagdzeit. 133(6): 144-148, illus. [In German. English summary.]

1408. _______
1966. Aussetzung von *Aphidecta obliterata* L. (*Coccinellidae*) auf der Nordseeinsel Amrum zur biologischen kontrolle der Sitkalaus (*Liosomaphis abietina* Walk. *Aphididae*). [Introduction of *A. obliterata* into the North Sea Island of Amrum for the biological control of *L. abietina.*] Anz. Schadlingsk 39(2): 26. [In German.]

1409. Schneider, Roswitha, and Paetzholdt, Marcus.
1964. *Ascochyta piniperda* als Erreger eines Triebsterbens an Blaufichten in Baumschulen. [*A. piniperda* as the cause of shoot blight of *Picea pungens* in nurseries.] Nachrichtenbl. Deut. Braunschweig. 16(5): 73-75, illus. [In German.]

1410. Schober, H.
1956. Ergebnisse von Anbauversuchen mit ausländischen Holzarten. [Results of trials of exotics.] Ned. Boschbouw-Tydsehr 28(8): 187-202, illus. [In German.]

Describes briefly the results of trials in Germany since about 1880 of a number of tree species, the most important being Douglas-fir, Sitka spruce, Japanese larch, and *Quercus borealis*.

1411. Schober, Reinhard.
1962. Die Sitka-Fichte. Eine biologisch-ertragskundliche Untersuchung. [*Picea sitchensis*. A study of its biology and yield.] Schr. Reihe Forstl. Fak. Univ. Gottingen 24/25, 230 pp., illus. [In German. English summary.]

A monograph, based chiefly on a study of 111 temporary and 58 permanent sample plots (45 German, 9 Danish, 3 British, and 1 Swedish), discussing climatic and soil requirements; injuries by fungi (particularly *Fomes annosus*), insects (particularly *Dendroctonus micans*), deer, drought, frost, wind, etc.; silviculture; suitable provenances; behavior in mixtures; growth of individual trees, yield and wood properties (the latter in a chapter by W. Knigge). Taper and volume tables are presented on the basis of an analysis of 1,234 stems, also tables of stem distributions, volume distribution over diameter classes, height-curve tables, and assortment tables for individual trees and stands. Yield tables for Germany, Denmark, Great Britain, and Sweden are compared. Rotations of 70 to 80 years or more are considered profitable. (From author's summary.)

1412. Schoonover, Shelley E.
1951. American woods. 250 pp., illus. Santa Monica, Calif.: Watling & Co.

1413. Schrader, O. Harry.
1943. The effect of grouped scarf joints in clear, laminated, glued beams of Douglas-fir and Sitka spruce. Timberman 44(9): 49-50, 52, 54, 57, illus.

1414. Schreiner, Ernst J.
1937. Improvement of forest trees. U.S. Dep. Agr. Yearbook 1937: 1242-1279, illus.

Lists among natural hybrids of forest trees *Picea sitchensis* X *P. canadensis*.

1415. Schubert, G. H.
1952. Germination of various coniferous seeds after cold storage. Calif. Forest & Range Exp. Sta. Res. Note 83, 7 pp.

Germination of Sitka spruce seed stored at 41° F. in airtight containers for 6 to 10 years was 68 percent. Seed stored 11 to 20 years germinated only 2 to 6 percent.

1416. Schwenke, H. J.
1960. Koniferenanzucht in einen neuartigen Saatbeet. [Raising conifers in a new type of seedbed.] Forst- und Holzwirt 15(10): 193-195, illus. [In German.]

The bed, 1 to 1.2 meters wide and about 20 centimeters deep, is dug out and filled in winter with 18 centimeters of compost (larch litter, larch raw humus, and slightly loamy humus sand plus grass and some fertilizers). This is topped with a 5-centimeter layer of a mixture of washed quartz sand (50 percent by volume), rubbed peat (25 percent), and chopped sphagnum moss (25 percent) to form the actual seedbed. The management and advantages of such beds are discussed and details are given on the growth of

1- and 2-year-old seedlings of nine coniferous species in the beds. The beds have proved good even with species usually difficult to raise, such as Sitka spruce.

1417. Scott, C. W.
1952. The properties and uses of conifer thinnings in Great Britain. Forestry 25(1): 1-9.

1418. _______ and MacGregor, W. D.
1953. Fast-grown wood, its features and value, with special reference to conifer planting in the United Kingdom since 1919. Forestry 26(2): 123-140.

1419. Scott, David R. M.
1962. Plant associations of western Washington. Univ. Wash. Arboretum Bull. 25(1): 11-14, 26.

1420. _______
1962. The Pacific Northwest region, pp. 503-570, illus. *In* Regional silviculture of the United States, John W. Barrett [ed.]. New York: The Ronald Press Co.

1421. _______
1962. The Alaska region, pp. 571-591, illus. *In* Regional silviculture of the United States, John W. Barrett [ed.]. New York: The Ronald Press Co.

1422. Seal, D.
1957. The supply of "home-collected" conifer seeds in Scotland. Arbor (Aberdeen) 3(1): 13-16.

1423. Seal, D. T., Matthews, J. D., and Wheeler, R. T.
1965. Collection of cones from standing trees. Great Brit. Forest. Comm. Forest Rec. 39, 48 pp., illus.

One bushel of Sitka spruce cones contains 1,300 cones and will yield an average of 11 ounces of cleaned seed. Approximately 29,000 seedlings may be produced from this seed, from which 10,000 transplants may be obtained. Seedling yields are extremely variable. Information is presented in tabular form for 15 conifer species including Sitka spruce.

1424. Selbo, M. L.
1963. Effect of joint geometry on tensile strength of finger joints. Forest Prod. J. 13: 390-400, illus.

Describes methods of marking and testing finger joints. Sitka spruce, Douglas-fir, and white oak were tested. Data on strength in relation to geometry of the joints are given, with guides for jointing.

1425. Serenius, R. S.
1956. Sulphite pulping of western hemlock, balsam, and spruce. Pulp & Pap. Mag. Can. 57(9): 133-137, illus.

Gives tables and graphs to show the yields and strengths of the pulps of the three species at constant permanganate number, cooking schedules, and screenings content. Also illustrates how the data from an experimental digester can be applied on a mill scale for various combination ratios of the raw materials.

1426. Shacklette, Hansford T.
1962. Biotic implications of Alaskan biogeochemical distribution patterns. Ecology 43(1): 138-139.

Young stems and leaves of 34 species of trees and shrubs, including Sitka spruce, growing in four regions of Alaska were analyzed chemically for copper, lead, zinc, and nickel content.

1427. Shanklin, John F.
1954. Natural areas. J. Forest. 52: 375-383.

1428. ______
1960. Society of American Foresters natural areas. J. Forest. 58: 905-917.

Lists natural areas recognized by the Society of American Foresters; includes those containing stands of Sitka spruce.

1429. Shantz, H. L., and Zon, R.
1924. Natural vegetation. *In* Atlas of American agriculture, part 1, sect. E., pp. 1-29, illus. U.S. Dep. Agr.

1430. Sharpe, Grant William.
1956. A taxonomical-ecological study of the vegetation by habitats in eight forest types of the Olympic rain forest, Olympic National Park, Washington. Diss. Abstr. 16(5): 1043. (Ph.D. thesis on file at Univ. Wash., 335 pp.)

1431. Shaw, C. G., and Harris, M. R.
1960. Important diseases and decays of trees native to Washington. Wash. State Univ. Agr. Ext. Serv. Bull. 540, 35 pp.

1432. Shaw, Charles Gardner.
1958. Host fungus index for the Pacific Northwest. I. Hosts. Wash. Agr. Exp. Sta. Cir. 335, 127 pp.

Thirty-seven fungi are listed as attacking Sitka spruce.

1433. Shaw, Elmer W.
1953. Direct seeding experiments on the 1951 Forks Burn. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Res. Pap. 9, 19 pp., illus.

A 40-acre burned-over study area in the Olympic National Forest was seeded by helicopter with a mixture of *Picea sitchensis, Pseudotsuga taxifolia, Tsuga heterophylla,* and *Chamaecyparis lawsoniana.* One year after sowing, 45 percent of the milacre plots were stocked with one or more live seedlings. Seedling survival by species during the first year was *P. taxifolia*, 45 percent; *T. heterophylla*, 32 percent; *P. sitchensis,* 18 percent; and *C. lawsoniana*, 16 percent. Some suggestions for improving methods of studying the effectiveness of direct seeding are made.

1434. Shaw-Stewart, Hugh.
1929. Report on various aspects of Sitka spruce on Ardgowah Estate, and various deductions arrived at. Scot. Forest. J. 43: 1-4.

1435. Shea, Keith R.
1960. Decay in logging scars in western hemlock and Sitka spruce. Weyerhaeuser Co. Forest. Res. Note 25, 7 pp. plus 6 tables.

Examination of 151 stems in a 90-year stand in Washington showed 187 scars dating from partial cutting 17 years before. Scars were most frequent on the stump and buttress roots, indicating that skidding was an important source of injury. Evidence of decay was found in 91 percent of scars on western hemlock and 88 percent of scars on Sitka spruce; losses due to decay averaged 0.9 percent of total merchantable volume. The decay-causing organisms are discussed.

1436. _______
1960. Deterioration--a pathological aspect of second-growth management in the Pacific Northwest. Weyerhaeuser Co. Forest. Res. Note 28, 16 pp., illus.

Discusses decay and deterioration associated with various forms of damage and causes of death. Tables and graphs are given for estimating probable volume of decay associated with scars of different size and age.

1437. _______
1960. Fungus succession and the significance of environment in the deterioration of logs. Weyerhaeuser Co. Forest. Res. Note 30, 7 pp.

Reviews some of the requirements for growth of wood-inhabiting fungi and cites some examples of fungus succession and significance of environment. Sitka spruce is included.

1438. _______
1964. *Rosellinia herpotrichioides* on Sitka spruce seedlings in Washington. Plant Dis. Rep. 48(6): 512-513, illus.

The fungus has caused mortality on 2-0 Sitka spruce seedlings in nursery beds. The disease was at its worst toward the center of overstocked beds, suggesting that high humidity and poor aeration favor the fungus. Reduced stocking to improve aeration is recommended. The disease is described. This is the first report of the disease in Washington on Sitka spruce and Douglas-fir seedlings.

1439. Sheldon, E. P.
1904. The forest wealth of Oregon. Lewis & Clark Exposition Comm., Portland, 32 pp., illus.

1440. Shelford, Victor E.
1963. The ecology of North America. 610 pp., illus. Urbana: Univ. Illinois Press.

Includes descriptions of Sitka spruce forest communities with particular emphasis on animal life in the forest.

1441. Sigafoos, Robert S.
1958. Vegetation of northwestern North America, as an aid in interpretation of geologic data. U.S. Geol. Surv. Bull. 1061-E: 165-185, illus., plus map.

1442. Siggins, Howard W.
1933. Distribution and rate of fall of conifer seeds. J. Agr. Res. 47(2): 119-128, illus.

Describes tests to determine the rate of seedfall of several conifer species in still air. Seed size in relation to fall rate is considered. Sitka spruce seed from California on the average weighed 0.0034 grams and fell at the rate of 3.1 feet per second.

1443. Silen, Roy R., and Woike, Leonard R.
1959. The Wind River Arboretum from 1912 to 1956. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Res. Pap. 33, 50 pp., illus.

Of the 20 species of spruce tried in the arboretum, 16 are doing fairly well but only *Picea abies* has done well enough to warrant further forest planting trials. Sitka spruce was attacked by *Chermes cooleyi* and also damaged by sapsuckers.

1444. Silver, G. T.
1962. The Sitka spruce weevil. Can. Forest Entomol. Pathol. Br. Annu. Rep. year ended March 31, 1962, p. 128.

1445. ________
1964. The Sitka spruce weevil. Can. Forest Entomol. Pathol Br. Annu. Rep. year ended March 31, 1963, p. 131.

Studies on the Sitka spruce weevil, *Pissodes sitchensis* Hopk. were continued with emphasis on completing the life history portion of the project. Weevils overwinter in the duff, start emerging in late April, and are present in the field until mid-July. Individual adults have lived up to 6 weeks in cages. Larvae are present from mid-May until December. New adults start emerging in late August and feed before hibernation.

1446. Simonson, Roy W., and Rieger, Samuel.
1967. Soils of the Andept suborder in Alaska. Soil Sci. Proc. 31(5): 692-699, illus.

Describes the major well-drained soils of nonmountainous areas of Kodiak Island, the Aleutian Islands, the Alaska peninsula, and the southwestern Kenai Peninsula. The soils were formerly classified in the Ando group on the basis of similarities to that group as originally proposed in Japan. Field relationships and the shared characteristics of B horizons suggest that Andepts are readily converted to Orthods (Podzols) following occupation by Sitka spruce forest.

1447. Sinden, John A.
1964. An economic analysis to aid the marginal decision on rotation length. I. Presentation of the principle. Forestry 37(2): 161-178.

Discusses general principles, using a specific Sitka spruce stand type as an example.

1448. Skinner, Edgel C.
1959. Cubic volume tables for red alder and Sitka spruce. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Res. Note 170, 4 pp.

Presents three tables supplementing or amending those previously published by the Station: Volume tables for permanent sample plots as recommended by the Puget Sound Research Center advisory committee for use in western Washington (28 tables (processed), 1953).

1449. Slade, Walter B.
1930. Drying Sitka spruce for airplane use. West Coast Lumberman 57(1): 18, 23.

1450. Sloan, G. M.
1957. Public Inquiries Act (British Columbia): Report of the Commissioner...relating to the forest resources of British Columbia, 1956. 2 vol., 888 pp. plus map. Victoria, Brit. Columbia: Queen's Printer.

1451. Smith, Clinton G.
1921. Regional development of pulpwood resources of the Tongass National Forest, Alaska. U.S. Dep. Agr. Bull. 950, 40 pp., illus.

1452. Smith, D. N.
1959. The natural durability of timber. Great Brit. Dep. Sci. Ind. Forest Prod. Res. Rec. 30 (Wood Preserv. Ser. 4), ed. 2, 26 pp., illus.

1453. _______ and Cockcroft, R.
1961. The preservative treatment of home-grown timbers by diffusion. Wood 26(12): 490-492, illus.

Exploratory experiments using a boron preservative have shown that fresh-sawn Sitka spruce can be penetrated through to the center by diffusion and have indicated the kind of preservative distribution obtained. The time required for diffusion was 3 weeks for material 1 inch thick, and 3 to 4 months for material 3 inches thick.

1454. Smith, DeWilton C.
1965. Planning a timber harvest in Alaska. J. Forest. 63: 341-343, illus.

1455. Smith, J. H. G., and Ker, J. W.
1957. Timber volume depends on D^2H. B.C. Lumberman 41(9): 28, 30.

Constants a and b for 24 tree species are given for the combined variable formula in which tree volume is estimated in terms of d.b.h. squared (D^2) and total height (H).

$$V = a + b \frac{D^2H}{100}$$

where V is volume. Constants for Sitka spruce are given for immature trees (all diameters) and for mature trees in three diameter classes. Standard errors are tabulated for very short and very tall trees.

1456. Smith, J. Harry G.
1964. Root spread can be estimated from crown width of Douglas-fir, lodgepole pine, and other British Columbia tree species. Forest. Chron. 40: 456-473, illus.

1457. _______ and Breadon, Robert E.
1964. Combined variable equations and volume-basal area ratios for total cubic-foot volumes of the commercial trees of B.C. Forest. Chron. 40: 258-261.

1458. Smitt, Anton.
1950. Fremmede treslag i vest-Norge. [Exotic species in western Norway.] Tidsskr. Skogbruk 58(6): 115-122, illus. [In Norwegian.]

Gives tabulated data on the quantities of seeds and plants of some exotic species used between 1928 and 1949 and of volume and increment from stands of Sitka spruce and other conifers.

1459. Smythe, D. M.
1921. *Abies menziesii* at Keilour, Perthshire. Roy. Scot. Arboretum Soc. Trans. 35: 82.

One of the first Sitka spruce planted in United Kingdom is said to have been planted in Scotland in 1834. When blown down in 1920 it was 103 feet tall.

1460. Society of American Foresters.
1964. Forest cover types of North America (exclusive of Mexico). 67 pp. Washington, D.C.

Presents a grouping of stands of similar composition and development into forest cover types. Sitka spruce type 223 consists of 80 percent or more Sitka spruce in the dominant crown canopy. Sitka spruce-western hemlock type 225 contains both species but neither in sufficient amount to constitute a pure type (80 percent). Nature and occurrence and transition forms and variants are described.

1461. Sødergaard, Poul.
1965. Kimplanternes morfologi og udvikling hos de I skovbruget almindeligt anvendte naletraeer. [Identification of one- and two-year seedlings of 25 conifers.] Dansk Dendrol. Arsskr. 2(11): 185-247, illus. [In Danish.]

1462. Somerville, H. C., and Stewart, G. G.
1957. A note on a high elevation wood in Midlothian. Scot. Forest 11(1): 23-25.

Describes a plantation made about 1870 at 1,600- to 1,675-foot elevation with a mixture of Norway, white, and Sitka spruce. The Sitka spruce performed better than either of the other two spruces.

1463. Sorenson, I. C.
1913. Akklimatiseret Sitkagran. [Acclimation of Sitka spruce.] Hedeselskabets Tidsskr. 1913: 267. [In Danish.]

1464. Sowder, A. M.
1961. 1960 Christmas tree data. J. Forest. 59: 829-830.

The 1960 total production of Christmas trees in the United States was 31,361,512 trees, of which 5,040 were Sitka spruce.

1465. Spada, Benjamin.
1962. Forest statistics for Island and Kitsap Counties, Washington, 1959; San Juan County, Washington, 1960. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Forest Surv. Rep. 142, 27 pp.

1466. ________
1962. Forest statistics for King County, Washington. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Forest Surv. Rep. 143, 27 pp., illus.

1467. ________
1962. Forest statistics for Jefferson County, Washington. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Forest Surv. Rep. 144, 26 pp.

1468. ________
1962. Forest statistics for Clallam County, Washington. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Forest Surv. Rep. 145, 26 pp.

1469. Sparhawk, W. N.
1919. Supplies and production of aircraft woods. U.S. Nat. Adv. Comm., Aeron. Rep. 67, 62 pp.

1470. Spaulding, Perley.
1956. Diseases of North American forest trees planted abroad. An annotated list. U.S. Dep. Agr. Handbook 100, 144 pp.

Lists 17 pathogens of Sitka spruce and locations in 19 countries where Sitka spruce has been planted.

1471. ________
1961. Foreign diseases of forest trees of the world. An annotated list. U.S. Dep. Agr. Handbook 197, 361 pp.

Lists *Ascochyta piniperda, Chrysomyxa ledi* var. *rhododendri, Pezicula livida,* and *Sparassis ramosa* as attacking Sitka spruce.

1472. Spencer, Alice.
1918. The spiral spruce. Amer. Forest. 24: 342, illus.

Describes a specimen of Sitka spruce from Alaska with concentric rings of dense wood in cross section, giving a "bull's eye" appearance.

1473. Spencer, D. A., and Kverno, N. B.
1953. Research in rodent control to promote reforestation by direct seeding. U.S. Fish & Wildlife Serv. Progr. Rep. 3, 56 pp. plus 29 tables, 14 diagrams, and 17 graphs.

1474. Sprague, Roderick, and Lawrence, Donald B
1959. The fungi on deglaciated Alaskan terrain of known age. I. Mendenhall Glacier Area. Wash. State Univ. Res. Stud. 27(3): 110-128, illus.

Reports on a study of development of vegetation and soil in southeastern Alaska, with emphasis on the fungi and their effect on decay of organic matter. Sitka spruce is an important member of the plant associations studied. Parts II and III are listed below.

1475. _______ and Lawrence, Donald B.
1959. The fungi on deglaciated Alaskan terrain of known age. II. Herbert Glacier Area. Wash. State Univ. Res. Stud. 27(4): 214-229, illus.

1476. _______ and Lawrence, Donald B.
1960. The fungi on deglaciated Alaskan terrain of known age. III. Glacier Bay Area. Wash. State Univ. Res. Stud. 28(1): 1-20, illus.

1477. Spurr, Stephen H.
1953. Post-war forestry in western Europe. Part 1.--England and Scotland. J. Forest. 51: 195-199.

1478. Spurway, C. H.
1941. Soil reaction (pH) preferences of plants. Mich. State Coll. Agr. Exp. Sta. Spec. Bull. 306, 36 pp.

Optimum soil pH range for Sitka spruce is 5.0 to 6.0. Maximum pH limit, beyond which damage may occur, is 7.0.

1479. Srivastava, T. N.
1951. The application of selective herbicides to forestry practice. Indian Forest. 77(3): 176-191 plus 4 plates.

1480. Stackelberg, S. Freiherr Von.
1963. Zeitbedarf und Energieverbrauch bei der winkelpflanzung. [Time and energy consumption in planting.] Allg. Forst- und Jagdzeit. 134(9): 244-254. [In German. English summary.]

A time and motion study of planting Sitka and Norway spruce.

1481. Stamm, A. J.
1929. The capillary structure of softwoods. J. Agr. Res. 38(1): 23-67.

Examines in detail, by dynamic physical methods, the capillary structure of six western conifers including Sitka spruce.

1482. _______
1959. Effect of polyethylene glycol on the dimensional stability of wood. Forest Prod. J. 9: 375-381, illus.

Polyethylene glycol-1000 stabilizes wood by bulking the fibers. It also serves as a chemical seasoning agent, suppressing decay in high concentrations, and has slight effect on physical properties, gluing, or finishing.

1483. ________ and Baechler, R. H.
1960. Decay resistance and dimensional stability of five modified woods. Forest Prod. J. 10: 22-26, illus.

1484. Stamm, Alfred J.
1946. Passage of liquids, vapors and dissolved materials through softwoods. U.S. Dep. Agr. Tech. Bull. 929, 80 pp., illus.

1485. ________
1953. Diffusion and penetration mechanism of liquids into wood. Pulp & Pap. Mag. Can. 54(2): 54-63, illus.

Measurements were made of water absorption by Sitka spruce heartwood blocks. Results show that the rate of natural penetration of water into wood in the fiber direction at different temperatures varies with the vapor pressure of the water and the inward diffusion of the vapor. Prepenetration of dry wood with NH^3 increases the rate of absorption almost to that obtained by evacuation, and the method may have possibilities as a rapid means of impregnating dry chips with cooking liquor during pulping.

1486. ________
1956. Dimensional stabilization of wood with carbowaxes. Forest Prod. J. 6: 201-204.

Specimens of Sitka spruce were soaked in water (controls), and in 25 percent (by weight) aqueous solutions of glycerine and of carbowaxes (polyethylene glycols) before ovendrying by successive stages. With carbowaxes of molecular weights between 200 and 600, almost complete stability was obtained; with higher molecular weights and with glycerine, stability was somewhat less. Weight increase due to deposition of carbowax averaged 50 percent. Carbowaxes can be easily leached, but it was possible to fix them with an equal weight of phenolic resin. The treatment, however, is likely to cause gluing and finishing difficulties.

1487. ________
1956. Thermal degradation of wood and cellulose. Ind. & Eng. Chem. 48(3): 413-417, illus.

1488. ________
1957. Adsorption in swelling versus nonswelling systems. I. Contact area. Tappi 40: 761-765.

1489. ________
1957. Adsorption in swelling versus nonswelling systems. II. Free energy change per unit area of effective molecular contact. Tappi 40: 765-770.

1490. ________
1959. Dimensional stabilization of wood by thermal reactions and formaldehyde cross-linking. Tappi 42: 39-44, illus.

Research was carried out on samples of Sitka spruce, Douglas-fir, and redwood to assess effects of a heat stabilization treatment, alone or together with a formaldehyde cross-linking reaction. Reductions of as much as 90 percent in swelling were attained with as little as 7 percent of bound formaldehyde, but the reaction greatly reduces the toughness and abrasion resistance of the wood.

1491. _______
1959. Bound-water diffusion into wood in the fiber direction. Forest Prod. J. 9: 27-32.

1492. _______
1960. Bound-water diffusion into wood in across-the-fiber directions. Forest Prod. J. 10: 524-528, illus.

1493. _______
1960. Combined bound-water and water-vapour diffusion into Sitka spruce. Forest Prod. J. 10: 644-648.

1494. _______
1964. Wood and cellulose science. 549 pp., illus. New York: Ronald Press Co.

1495. _______ and Wagner, Eugene.
1961. Determining the distribution of interstructural openings in wood. Forest Prod. J. 11: 141-144, illus.

1496. Stanek, Walter.
1965. Environment of Sitka spruce; a literature review. Brit. Columbia Univ. Fac. Forest., 51 pp.

Prepared under the direction of P. G. Haddock. Contains 51 references. Section on nomenclature is especially interesting.

1497. Starker, T. J.
1934. Fire resistance in the forest. J. Forest. 32: 462-467.

Lists Sitka spruce as the least fire resistant of 12 native conifers in Oregon and Washington.

1498. Steer, Henry B.
1948. Lumber production in the United States 1799-1946. U.S. Dep. Agr. Misc. Pub. 669, 233 pp., illus.

Includes one table listing annual production of spruce, hemlock, cedar, and miscellaneous lumber from 1799 to 1946.

1499. Stefansson, Valtyr.
1951. Nokkrar: stadreyndir um skograektina. [Some facts about forestry.] Ársrit Skógraektarf. Island 1950: 5-23, illus. [In Icelandic.]

Includes some data on the growth of Sitka spruce in Iceland.

1500. Stein, William I.
1966. Sampling and service testing western conifer seeds. West. Forest. & Conserv. Ass. Forest Tree Seed Counc., 36 pp.

Gives instructions for handling seed and tabulates by species procedures for conducting laboratory germination tests. Standard germination test for Sitka spruce is to place seed on top of blotters in covered petri dishes for 21 days with 20° C. night and 30° C. day temperature and at least 8 hours of fluorescent light.

1501. Stephens, F. R., and Billings, R. F.
1967. Plant communities of a tide-influenced meadow on Chichagof Island, Alaska. Northwest Sci. 41(4): 178-183, illus.

Dense Sitka spruce-western hemlock timber stands are usually found adjacent to the communities described, often with a brushy ecotone between.

1502. Sterling, E. A.
1918. Flying on wings of spruce. Amer. Forest. 24(291): 133-139, illus.

1503. Steven, H. M.
1928. Nursery investigations. Great Brit. Forest. Comm. Bull. 11, 181 pp. plus 6 plates.

1504. _______
1940. Choice of tree species in the northeast of Scotland on the basis of soil and vegetation types. Forestry 14(2): 81-85.

1505. _______
1953. Storm damage to woodlands in Scotland on January 31, 1953. Nature 171(4350): 454-456, illus.

Describes the nature and extent of storm damage and discusses problems of salvage. Few stands less than 40 feet in height were damaged. Scots pine suffered most heavily, both absolutely and relatively to Sitka spruce, larch, and Douglas-fir. Beech and oak were also blown over.

1506. Stevens, M. E.
1965. Relation of vegetation of some soils in southeastern Alaska. *In* Forest-soil relationships in North America, Chester T. Youngberg [ed.]. North Amer. Forest Soils Conf., pp. 177-188.

1507. Stevens, W. C.
1960. Twist in Sitka spruce. Timber Trades J. 232: 83-85, illus.

1508. _______ and Johnston, D. D.
1961. The seasoning properties of home-grown Sitka spruce. J. Inst. Wood Sci. (London) 7: 28-33, illus.

The seasoning properties of British-grown Sitka spruce were examined with reference to the regions and sites from which it was obtained. It was shown that this material does not tend to split or check when drying, even at high temperatures and low humidities, but does tend to twist. A very severe drying schedule was finally recommended. Statistical analysis of the data failed to show differences of any significance between the final quality of the dried material from the six regions sampled, but they indicated a highly significant difference in seasoning properties between material from different sites and also from different trees. (From authors' summary.)

1509. _______, Johnston, D. D., and Baud, M. J.
1961. The specific gravity and moisture content of freshly felled conifers. Great Brit. Forest Prod. Res. Lab. (Princes Risborough). 20 pp. (Reprinted in 1966.)

1510. _______ and Turner, N.
1942. Chemical bending: the influence of urea treatments on the bending and setting properties of wood laminations. Wood 7: 123-126, illus.

Tests on British-grown oak and beech and imported Sitka spruce confirm that urea-treated wood heated in an oven can readily be bent, but indicate that the degree of flexibility achieved is no greater than would result from immersing the material in boiling water.

1511. Stewart, G. G.
1959. Preliminary results of experiments in drain deepening in two border forests. *In* Report on forest research for the year ended March 1958. Great Brit. Forest. Comm., pp. 131-137. London: H. M. Stationery Office.

Describes the results of deepening drains from 6 to 9 inches to 24 inches in Sitka spruce forests on Molinia peat overlying clay. In one case, there was little effect on the water table between the drains whereas in the other the water level was reduced by 5 inches. In both cases, there was no significant effect on tree growth.

1512. _______
1961. Experimental introductions of alternate species into pioneer crops on poor sites. *In* Report on forest research for the year ended March 1960. Great Brit. Forest. Comm., pp. 151-166 plus 7 plates. London: H. M. Stationery Office.

1513. _______
1962. Kergord Plantations, Shetland. Forestry 35(1): 35-56 plus 2 plates.

Describes seven shelterbelts (9 acres in all) established between 1913 and 1920. They were planted as row-by-row mixtures with a number of species. In these rigorous conditions, Sitka spruce was outstandingly successful.

1514. Stirling-Maxwell, John.
1931. Sitka spruce--on poor soils and at high elevations. Forestry 5: 96-99.

Because of its ability to grow under difficult conditions, Sitka spruce has opened a new era and extended the limit of economic forestry in Britain.

1515. _______
1932. The influence of exotic conifers on silviculture in the British Isles. *In* Conifers in cultivation. Rep. Conifer Conf., Roy. Hort. Soc., London, pp. 43-54, illus.

Discusses Sitka spruce planted in the British Isles. The species is planted on a large scale, this year over 12 million seedlings having been planted by the Forestry Commission alone. Seed source is important, and seed from Queen Charlotte Islands and Alaska are suitable.

1516. Stokes, W. B.
1925. Canadian softwoods. Can. Dep. Int. Forest. Br. Circ. 19, 13 pp., illus.

1517. Stone, Herbert.
1904. The timbers of commerce and their identification. 311 pp., illus. London: William Rider & Son.

1518. Streets, R. J.
1962. Exotic forest trees in the British Commonwealth. 765 pp., illus. Oxford: Clarendon Press.

1519. Sudo, Syoji.
1955. Wood anatomical studies on the genus *Picea*. Tokyo Univ. Forest. Bull. 49: 179-204 plus 16 photos.

1520. Sudworth, G. B.
1898. Check list of the forest trees of the United States, their names and ranges. U.S. Dep. Agr. Bull. 17, 144 pp.

1521. Sudworth, George B.
1897. Nomenclature of the arborescent flora of the United States. U.S. Dep. Agr. Div. Forest. Bull. 14, 417 pp.

1522. _______
1908. Forest trees of the Pacific slope. U.S. Dep. Agr. Forest Serv., 441 pp., illus.

Describes the appearance, habitat, silvics, size, and uses of Sitka spruce.

1523. _______
1927. Check list of the forest trees of the United States, their names and ranges. U.S. Dep. Agr. Misc. Circ. 92, 295 pp.

1524. Sunley, J. G.
1955. The strength of timber struts. Great Brit. Forest Prod. Res. Spec. Rep. 9, 28 pp. plus 3 photos.

Gives the results of tests on struts of the type used in light construction. Species tested included Sitka spruce. The use of formulae in calculating strengths is discussed.

1525. _______ and Lavers, Gwendoline M.
1961. Variations in the strength and specific gravity of Sitka spruce grown in Great Britain. J. Inst. Wood Sci. 7: 15-27, illus.

Sitka spruce, widely used in afforestation by the Forestry Commission, is known to show considerable variation in quality, and the causes of this are not fully known. Variations in strength and specific gravity were measured and related to the different geographical regions and site factors. Results indicate that the growth region has a small effect, but large variations occur between trees on the same site, although between-site and within-tree variations cannot be neglected. In addition, the relation between the "quality class" of the site and the properties is examined and the possibility of using tree girth in estimating timber properties is discussed. (From authors' summary.)

1526. Swanston, Douglas N.
1967. Debris avalanching in thin soils derived from bedrock. Pacific Northwest Forest & Range Exp. Sta. USDA Forest Serv. Res. Note PNW-64, 7 pp., illus.

Describes reconnaissance investigations of debris avalanches in shallow soils in southeast Alaska. In all cases described, slopes were steep and supported old-growth stands of Sitka spruce and western hemlock.

1527. Tailte, An Roinn.
1963. Fo-roinn na foraoiseac ta. [Report of the Minister for Lands on Forestry.] Dublin 1962/63, 38 pp. plus 4 plates, map.

Describes planting and management of Sitka spruce in Ireland.

1528. Tambs-Lyche, Helen.
1957. Bladlusangrepene på Sitka-gran. [Aphis attack on Sitka spruce.] Norsk. Skogbruk. 3(18): 470, 473, illus. [In Norwegian.]

A number of outbreaks of *Liosomaphis* (*Neomyzaphis*) *abietina* have been reported from Vestland. Slight attacks were found on Norway spruce, which may have been the original host. The insect and the damage are described.

1529. Tarkow, Harold, and Southerland, Carole.
1964. Interaction of wood with polymeric materials. I. Nature of the adsorbing surface. Forest Prod. J. 14: 184-186.

1530. _______ and Stamm, Alfred J.
1960. Diffusion through air-filled capillaries of softwoods--Part I. Carbon dioxide. Forest Prod. J. 10: 247-250, illus.

1531. _______ and Stamm, Alfred J.
1960. Diffusion through air-filled capillaries of softwoods--Part II. Water vapor. Forest Prod. J. 10: 323-324, illus.

1532. Tarrant, R. F., Isaac, L. A., and Chandler, R. F., Jr.
1951. Observations on litter fall and foliage nutrient content of some Pacific Northwest tree species. J. Forest. 49: 914-915.

Gives annual ovendry weight of litter fall, nutrient content of foliage (pounds per acre), and soil pH at three depths under several tree species including Sitka spruce.

1533. Taylor, R. F.
1929. The role of Sitka spruce in the development of second-growth in southeastern Alaska. J. Forest. 27: 532-534.

Mixed stands of Sitka spruce and western hemlock are more productive than pure stands of either species. A high percentage of spruce in the stand is desirable. Volume and quality of stands having different percentages of spruce by basal area are compared.

1534. ______ 1930. Sitka spruce on the Tongass Forest looks south. Forest Worker 6(2): 14.

On the Tongass Forest most timber sales have been made on areas with southerly aspects, indicating that better quality timber occurred here. Of 37 areas on which yield studies were made, those with southerly aspects averaged 56.2 percent Sitka spruce with an average site index of 73.5 (50-year basis), whereas northeast slopes average 22.37 percent Sitka spruce with an average site index of 67.5.

1535. ______ 1931. Two extremes of forest soils in southeastern Alaska. Forest Worker 7(6): 10-11.

Sample quadrats and belt transects showed that the optimum soil type for Sitka spruce reproduction consists of glacial silt and gravel lightly covered by a mold formed by the debris of pioneer plants, mostly willows, alders, and poplars.

1536. ______ 1932. Plant indicators in southeastern Alaska. J. Forest. 30: 746.

In connection with a study of site prediction after the removal of virgin timber, all the important vegetation was listed on a number of plots in the hemlock-spruce type in southeastern Alaska. The lists seem to show that a definite correlation exists between the occurrence of certain of the plants noted and site index as indicated by total height at 100 years of age.

1537. ______ 1933. Site prediction in virgin forests of southeastern Alaska. J. Forest. 31: 14-18.

Discusses the climax forest in southeastern Alaska, its relation to even-aged stands, and the effect of logging and other factors on the succession from one to the other. The possibility of applying ordinary yield table methods of site classification to these forests is also described.

1538. ______ 1934. Yield of second-growth western hemlock-Sitka spruce stands in southeastern Alaska. U.S. Dep. Agr. Tech. Bull. 412, 30 pp., illus.

Normal yield tables for mixed even-aged stands in southeast Alaska.

1539. ______ 1949. First records of growth for Alaska's young stands. USDA Forest Serv. Alaska Forest Res. Center Tech. Note 1, 1 p.

Compares actual growth records from mixed even-aged Sitka spruce-western hemlock stands with growth predicted from normal yield tables (U.S. Dep. Agr. Tech. Bull. 412) and concludes that the yield tables are reliable.

1540. _______
1949. First results of thinning in Alaska. USDA Forest Serv. Alaska Forest Res. Center Tech. Note 3, 1 p.

Describes 20-year results of thinning in a mixed western hemlock-Sitka spruce stand at age 30 years in southeast Alaska.

1541. _______
1950. Alaska forest research problems and program. Alaska Sci. Conf. Proc. 1950: 11-19.

1542. _______
1950. Cubic form class volume tables for southeast Alaska. Alaska Forest Res. Center Tech. Note 6, 6 pp.

1543. _______ and Godman, R. M.
1950. Increment and mortality in southeast Alaska's second-growth stands. J. Forest. 48: 329-331.

Second-growth stands, consisting of about half Sitka spruce and half western hemlock by volume, produce double the average volume of the climax forests in about 80 years. Diameter growth of spruce is faster than that of hemlock, except in very young stands, and increases with the diameter of the tree. Diameter growth of spruce by site classes is usually greater than that of hemlock of the same site class. Within species, each site-class growth rate is at least double the next lower rate. Within diameter classes, the mortality percent of spruce is greater than that of hemlock, but the total mortality of hemlock exceeds that of spruce. Volume growth of spruce is greater than that of hemlock except in trees of very small diameters, and increases with the diameter of the tree. Site 1 and 2 spruce and site 1 hemlock should be selected as crop trees in stands selected for thinning and pruning. (Authors' summary.)

1544. Taylor, Ray F.
1930-31. Indicator vegetation on cutover lands of southeastern Alaska. Univ. Wash. Forest Club Quart. 9(1): 21-27.

Describes habitat conditions and vegetation species associated with Sitka spruce regeneration on cutover land.

1545. _______
1932. The successional trend and its relation to second-growth forests in southeastern Alaska. Ecology 13(4): 381-391.

Successional trends are described in the climax forests of southeastern Alaska. Plants characteristically found on four common habitats are listed, and it is shown that each group roughly indicates one of four stages in the successional trend.

1546. _______
1956. Alaska. *In* World geography of forest resources, Haden-Guest, S. Wright, and Teclaff [eds.]. Amer. Geogr. Soc. Spec. Pub. 33, pp. 115-125, illus.

1547. _______ and Little, Elbert L., Jr.
1950. Pocket guide to Alaska trees. U.S. Dep. Agr. Handbook 5, 63 pp., illus.

1548. Taylor, Raymond Frank.
1934. Available nitrogen as a factor influencing the occurrence of Sitka spruce and western hemlock seedlings in the forests of southeastern Alaska. 143 pp., illus. (Ph.D. thesis on file at Yale Univ.)

1549. _______
1935. Available nitrogen as a factor influencing the occurrence of Sitka spruce and western hemlock seedlings in the forests of southeastern Alaska. Ecology 16(4): 580-602, illus.

Nitrogen in available form was found to be an important factor in the occurrence of Sitka spruce. Up to a certain level, increased available nitrogen favored spruce establishment. Ammoniacal nitrogen accumulates in organic seedbeds where oxidation to nitrates cannot occur. Spruce seedlings are scarce on such seedbeds but western hemlock seedlings are abundant. The power of nitrification varies significantly with the overstory and seedbed. Differences are discussed. Also discussed are pH values of various seedbeds.

1550. Teesdale, C. H.
1914. Relative resistance of various conifers to injection with creosote. U.S. Dep. Agr. Bull. 101, 43 pp., illus.

1551. Tennas, Magnus E., Ruth, Robert H., and Berntsen, Carl M.
1954. An analysis of production and costs in high-lead yarding. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Res. Pap. 11, 37 pp., illus.

Factors influencing production and costs on a high-lead yarding operation in a 100-year-old Sitka spruce-western hemlock stand are isolated and analyzed.

1552. Thaarup, P.
1945. Bastarden Sitkagran X hvidgran. [The hybrid Sitka spruce X white spruce.] Dansk Skovforen. Tidsskr. 9: 381-384. [In Danish.]

Where Sitka spruce and white spruce are grown together, crossing occurs to such an extent that it is impossible to harvest pure Sitka seed. Brief descriptions and sample plot data are given for hybrid stands in Husby plantation and Thornby plantation.

1553. _______
1954. The afforestation of the sand dunes of the western coast of Jutland, Denmark. Advanc. Sci. 11(41): 38-41.

Discusses the development of sand-dune planting, the value and characteristics of the main species used including Sitka spruce, and costs and yields.

1554. Thelen, Rolf.
1929. Kiln drying handbook. U.S. Dep. Agr. Dep. Bull. 1136, 96 pp., illus.

Gives general kiln-drying schedules for various softwood species and special aircraft lumber schedules for several species including Sitka spruce.

1555. Thompson, Allen E.
1924. The forest resources of Washington. Univ. Wash. Forest Club Quart. 3(1): 19-32, illus.

1556. Thompson, R. T.
1959. *Polydrusus impar* (Gozis) (Col., Curculionidae) in Britain. Entomology 95(1136): 15.

The insect is reported from Sitka spruce in Rockingham Forest, Northants. It occurs commonly in the mountains of France and central Europe on *Picea abies* and *Pinus sylvestris* and has spread to conifer plantations in the Seine basin.

1557. _______ and Styles, J. H.
1958. *Otiorrhynchus niger* (F.) (Col., Curculionidae) in Britain. Entomology 94(1131): 183.

A record of the insect on Sitka spruce in Northamptonshire; the larvae attack the roots, and the adults feed on the leaves. It is believed to be the first British record of the insect, which is normally found in the mountainous regions of central and southern Europe.

1558. Thomsen, M.
1939. Angreb af *Tomicus chalcographus* paa Sitkagraner, Rødgraner, og Douglasgraner. [Attack of *T. chalcographus* on young Sitka spruce, Norway spruce, and Douglas-fir.] Forstl. Forsøgsv. Danmark 15: 199-208. [In Danish. English summary.]

In 1936, and especially in 1938, many young stands of Sitka and Norway spruce were heavily damaged by the insect. The primary cause was probably spring frost injury to the cambium, but there was evidence that most of the young trees did not succumb to the direct effect of the frost.

1559. Thulin, I. J.
1963. Forest tree improvement. New Zeal. Forest Serv. Forest Res. Inst. Rep. 1962: 36-39.

The importance of seed origin in Sitka spruce was demonstrated in a nursery trial of four provenances sown in a randomized trial. Mean heights of 2-year plants were 25 inches and 26.6 inches for California seed origins, 14.1 inches for an Oregon provenance, and 8.3 inches for a seed lot collected in one of the best stands of Sitka spruce in New Zealand. Height growth of the New Zealand origin ceased significantly earlier in the autumn than that of California provenances.

1560. _______, Will, G. M., and Bassett, C.
1958. A pilot trial of soil sterilization in a forest nursery. New Zeal. J. Forest. 7(5): 88-93, illus.

A soil sterilization trial with chloropicrin and formalin on a light-textured pumice soil resulted in a significant reduction in seedling mortality and an increase in growth. Plant analyses indicate an improvement in the availability of nutrients, particularly potash. In this respect the chloropicrin was the more effective. Species used in the trial were *Pinus radiata, P. nigra, Pseudotsuga taxifolia, Larix decidua,* and *Picea sitchensis*. (Authors' summary.)

1561. Titmuss, F. H.
1964. Commercial timbers of the world. Ed. 3, 277 pp., illus. London: Tech. Press, Ltd.

1562. Torgersen, Torolf R., and Baker, Bruce H.
1967. The occurrence of the hemlock looper (*Lambdina fiscellaria* (Guenee)) (Lepidoptera: Geometridae) in southeast Alaska, with notes on its biology. Pacific Northwest Forest & Range Exp. Sta. USDA Forest Serv. Res. Note PNW-61, 6 pp., illus.

The collection and subsequent identification of the hemlock looper is the first record of this insect in Alaska. About 396 acres of Sitka spruce were heavily defoliated in the outbreak. The insect is described.

1563. Toumey, James W., and Korstian, Clarence F.
1952. Seeding and planting in the practice of forestry. Ed. 3, 520 pp., illus. New York: John Wiley & Sons.

1564. _______ and Stevens, Clark L.
1928. The testing of coniferous tree seeds at the School of Forestry, Yale University 1906-1926. Yale Univ. Sch. Forest. Bull. 21, 46 pp., illus.

Germination of Sitka spruce seldom gets well underway within a period of 20 to 30 days, and usually many sound seeds remain ungerminated after a period of 50 days. Based on 14 samples, average germination capacity was 31.9 percent and maximum was 72 percent. Number of seeds per pound varied from 186,880 to 411,600. The average was 256,991.

1565. Trappe, James M.
1961. Strong hydrogen peroxide for sterilizing coats of tree seed and stimulating germination. J. Forest. 59: 828-829.

Soaking Sitka spruce seed for one-half hour in a 35-percent solution of H_2O_2 stimulated germination and sterilized seedcoats without damage to the embryo.

1566. _______
1961. Some probable mycorrhizal associations in the Pacific Northwest. III. Northwest Sci. 35(3): 91-94.

Lists the following fungi observed in mycorrhizal association with Sitka spruce: *Amanita vaginata, Russula delica, Russula emetica, Suillus piperatus, Xerocomus zelleri.*

1567. ________
1962. Fungus associates of exotrophic mycorrhizae. Bot. Rev. 28(4): 538-606.

1568. ________
1963. Some probable mycorrhizal associations in the Pacific Northwest. IV. Northwest Sci. 37(1): 39-43.

Several probable mycorrhizal associations with Sitka spruce and western hemlock are listed.

1569. ________
1964. Mycorrhizal hosts and distribution of *Cenococcum graniforme.* Lloydia 27(2): 100-106, illus.

1570. Troll, C.
1955. Der Mount Rainier und das Mittlere Cascaden-gebirge. [Mount Rainier and the middle Cascade Range.] Erdkunde 9: 264-274, illus. [In German.]

1571. Troup, R. S.
1932. Exotic forest trees in the British Empire. 259 pp. Oxford: Clarendon Press.

1572. Truax, T. R.
1930. Gluing wood in aircraft manufacture. U.S. Dep. Agr. Tech. Bull. 205, 58 pp.

1573. Tulstrup, N. P.
1951. Et gødningsforsøg I Egelund planteskole. [An experiment with fertilizers at the Egelund Nursery.] Dansk Skovforen. Tidsskr. 36(3): 105-114, illus. [In Danish.]

Plots were fertilized with combinations of N (350 kilograms $Ca(NO_3)_2$ per hectare), P (150 kilograms 18 percent superphosphate per hectare), K (150 kilograms 40 percent K fertilizer or $(NH_4)_2SO_4$ per hectare), or with stable manure, or were left untreated before planting with 2 + 0 Sitka spruce and other species. 2P + K + N and 2N + K + P stimulated height growth of Sitka spruce whereas 2K reduced it. Results with other species are also discussed and some figures for cost of the different fertilizers are given.

1574. Turner, N.
1952. The bonding of Sitka spruce scarf joints for use in laminated beams. *In* Selected government research reports, vol. 8, rep. 14, pp. 105-109, illus. London: H. M. Stationery Office.

1575. ________
1952. The limiting radii of curvature of Sitka spruce, western hemlock, and Douglas-fir sliced laminae (with an appendix on the effect of "loose" face on such radii). *In* Selected government research reports, vol. 8, rep. 16, pp. 118-122, illus. London: H. M. Stationery Office.

1576. _______ and Dean, A. R.
1952. A new type of bent corner. Wood 17(12): 462-468, illus.

1577. _______ and Webster, C.
1947. The effect of method of conversion, i.e., sawn or sliced, on the limiting radii of curvature of Sitka spruce laminae. Great Brit. Forest Prod. Res. Lab. Sci. & Tech. Memo. 31/46-FP32 RIS38.

1578. Tusko, Frank F.
1960. Application of plantsociological principles to the studies of the forest of the Powell River Co., Ltd. in Long Bay (Louis Lake). 11 pp., illus. (Thesis on file at Univ. Brit. Columbia.)

Forest types and their silvicultural relations are described. Sitka spruce with western white pine occurs at the edges of the sphagnum-bog type. Recommended silvicultural treatment of the bog type, on biological grounds, is drainage and saddle pattern planting with western hemlock, Sitka spruce, western redcedar, and western white pine.

1579. Twerdal, M. P., and MacLean, C. D.
1957. Forest statistics for Tillamook County, Oregon. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Rep. 130, 34 pp., illus.

1580. Ugolini, Fiorenzo C.
1966. Soils. *In* Soil development and ecological succession in a deglaciated area of Muir Inlet, southeast Alaska. Inst. Polar Stud. Rep. 20, Part 3, pp. 29-72, illus.

A study of soil development following recent deglaciation. Sitka spruce is a component of the biota. The influence of plants on soil development is discussed.

1581. Urbas, Janko.
1951. O Nasadh Sitke (*Picea sitchensis*) v Slovenji. [Plantations of Sitka spruce in Slovenia.] Gozd. Vestn. 9(1/2): 20-26, illus. [In Slovenian.]

A general account, which includes detailed measurements for a small plot on the Skrbsovo estate in 1948.

1582. Usher, Jack H., and Hall, Hoyt H.
1957. Forest statistics for Lincoln County, Oregon. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Rep. 129, 30 pp., illus.

1583. U.S. Bureau of the Census.
1966. Lumber production and mill stocks 1964. U.S. Dep. Com. Current Ind. Rep. Ser. M24T(64)-1, 8 pp.

One of a series of annual lumber and mill stock reports prepared by the U.S. Bureau of the Census. Lists production of softwoods and hardwoods in the United States by area and by the more important lumber species. Sitka spruce is among the species reported.

1584. U.S. Corps of Engineers.
1963. Terrain study of Alaska, Part V: Vegetation. Eng. Intelligence Study EIS-301. Publ. Corps Eng., Army Map Serv., Washington, D.C.

Consists of a map approximately 32 by 46 inches, scale 1:2,500,000, showing vegetation types, one of which is "very high evergreen hemlock-spruce forest," which includes Sitka spruce.

1585. USDA Forest Service.
1957. Shrinking and swelling of wood in use. (Rev.: Information reviewed and reaffirmed.) Forest Prod. Lab. Rep. 736, 11 pp. plus 7 tables, 2 figs.

Tables show shrinkage values for Sitka spruce.

1586. _______
1961. Standard terms for describing wood. (Rev.) Forest Prod. Lab. Rep. 1169, 2 pp. plus 9 tables.

1587. _______
1963. Characteristics of Alaska woods. Forest Prod. Lab. Res. Pap. FPL-1, 64 pp., illus.

Contains information on the characteristics and utilization of 11 Alaskan woods including Sitka spruce. Mechanical characteristics, seasoning data, and preservative treatments of the species are discussed and tables summarizing strength properties, pulp processes and yields, and drying schedules are included.

1588. _______
1963. The identification of Douglas-fir wood. (Rev.) Forest Prod. Lab. Res. Note FPL-010, 2 pp.

Revises a note first published in 1923, briefly describing differences between the wood of Douglas-fir and of other softwoods used for similar purposes, including Sitka spruce. Color of heartwood is pale pinkish brown; split or dressed surfaces have a silky sheen; tangentially split or dressed surfaces have a dimpled appearance; slight exudation of resin is occasionally present; odor is not pronounced.

1589. _______
1964. Pulp yields for various processes and wood species. Forest Prod. Lab. Res. Note FPL-031, 2 pp. plus 4 tables.

Lists density, fiber length, and typical pulp yields, as obtained primarily by kraft and sulfite processes, from many softwood and hardwood species grown in the United States, including Sitka spruce.

1590. _______
1928. Growth in the spruce-hemlock type. Pacific Northwest Forest Exp. Sta. Forest Res. Note 1, 4 pp.

1591. _______
1948. Woody-plant seed manual. U.S. Dep. Agr. Misc. Pub. 654, 416 pp., illus.

Gives information on time of flowering, cone ripening, seed periodicity, time of collection, seed yields, purity, soundness, and cost of seed. Sitka spruce cones yield 8 to 20 ounces of seed per bushel. Average number of seed per pound is 210,000. Recommendations are given for seed germination tests. Average germinative capacity is 60 percent.

1592. ______ 1950. The forests of Alaska. Alaska Reg., 18 pp., illus.

Contains a description of Alaska's forests and of Sitka spruce which comprises 21 percent of the coastal forest type.

1593. ______ 1953. Volume tables for permanent sample plots as recommended by the Puget Sound Research Center Advisory Committee for use in western Washington. Pacific Northwest Forest & Range Exp. Sta., 2 pp. plus 28 tables.

1594. ______ 1954. Sitka spruce. Useful trees of the United States--No. 9. U.S. Dep. Agr., 4 pp., illus.

1595. ______ 1954. Alaska's forests. (Rev. 1963.) U.S. Dep. Agr., 8 pp.

Briefly describes Alaska's National Forests and gives timber production data. Sitka spruce supplies most of the present Alaskan requirements for saw logs and is manufactured into all the usual forms of lumber. Sitka spruce composes 34 percent of the stand.

1596. ______ 1955. Chemical brush control. *In* Annual report 1954. Alaska Forest Res. Center Sta. Pap. 2, pp. 18-19.

Dense brush in plots containing western hemlock and Sitka spruce seedlings was successfully killed by an NH_4 sulfamate spray applied at the rate of 1 gallon of spray per 400 square feet (100 gallons spray or 54 pounds chemical per acre). Mortality of western hemlock seedlings was high, but Sitka spruce was killed only by direct heavy spray.

1597. ______ 1955. Seasonal distribution of leader and radial growth of saplings of western hemlock and Sitka spruce. *In* Annual report 1954. Alaska Forest Res. Center Sta. Pap. 2, p. 24.

Presents growth data for Sitka spruce and western hemlock for 1 year from the Ketchikan area of the Tongass National Forest, Alaska.

1598. ______ 1955. The black-headed budworm. *In* Annual report 1954. Alaska Forest Res. Center Sta. Pap. 2, pp. 26-29.

One year of heavy budworm defoliation on Sitka spruce advanced reproduction and poletimber caused leader kill in 86 percent of the dominant trees, 71 percent of the codominants, 71 percent of intermediates, and

29 percent of the suppressed trees. All current year's growth was defoliated throughout the top 16 feet of dominant spruce, the top 8 feet of codominant spruce, and the top 4 feet of the intermediate spruce.

1599. ________
1955. Wood handbook. U.S. Dep. Agr. Handbook 72, 528 pp., illus.

Contains basic information on wood as a material of construction with data for its use in design and specification. Tabular values are given for specific gravity, electrical resistance, moisture content, shrinkage, and strength.

1600. ________
1956. Wood: colors and kinds. U.S. Dep. Agr. Handbook 101, 36 pp., illus.

Contains brief descriptions and colored photos of radial, tangential, and cross-section samples of many American woods including Sitka spruce.

1601. ________
1957. Forest resources and forest industries of Lane County, Oregon. Pacific Northwest Forest & Range Exp. Sta. Forest Surv. Rep. 131, 117 pp., illus.

1602. ________
1959. General log grading rules for Sitka spruce and western hemlock. Alaska Reg. 7 pp.

1603. ________
1961. Wildling Sitka spruce. Pacific Northwest Forest & Range Exp. Sta. Annu. Rep. 1960: 73-74.

Wildling stock was compared with 3 + 0 nursery stock. At the time of planting wildling stock was twice as large, and after three growing seasons it showed better survival and had increased its initial height advantage. Wildlings are very abundant in many areas and cost $2.65 per 1,000 delivered at a 4-mile-distant planting site versus $11 per 1,000 for nursery stock. Only about half as many, however, could be planted per man-day.

1604. ________
1965. Timber trends in the United States. U.S. Dep. Agr. Forest Resource Rep. 17, 235 pp., illus.

1605. ________
1966. 1966 seed and planting stock dealers; a directory of commercial dealers in seeds and planting stock for common trees and shrubs. Tree Planters' Note 78, 29 pp.

The directory lists 12 sources of Sitka spruce seed and five sources of Sitka spruce planting stock.

1606. U.S. Department of Agriculture.
1949. Trees. The yearbook of agriculture. 944 pp., illus.

1607. ________
1961. Seeds. The yearbook of agriculture. 591 pp., illus.

1608. U.S. Department of Commerce.
1966. Product standard PS 1-66. Softwood plywood, construction and industrial. A recorded voluntary standard of the trade. Nat. Bur. Stand., 25 pp., illus.

Describes standards for grading softwood plywood by group, according to species including Sitka spruce.

1609. U.S. Spruce Production Corporation.
1919. History of spruce production division. 126 pp., illus. Portland, Oreg.: Kilham Stationery & Printing Co.

Describes organization and production records of the spruce production division, U.S. Army, and United States Spruce Production Corporation, which supplied aircraft timber during World War I.

1610. U.S. Tariff Commission.
1929. Logs of fir, spruce, cedar, or western hemlock. Report to the President of the U.S. Senate Finance Committee. 42 pp. plus map.

1611. Vaartaja, O.
1957. The susceptibility of seedlings of various tree species to *Phytophthora cactorum*. Can. Dep. Agr. Forest Biol. Div. Bi-mon. Progr. Rep. 13(2): 2.

1612. _______
1959. Evidence of photoperiodic ecotypes in trees. Ecol. Monogr. 29: 91-111, illus.

The hypothesis of photoperiodic ecotypes was tested with 38 tree species (including Sitka spruce) of 19 genera and 81 seed sources from various latitudes in the northern hemisphere. The four greenhouse test conditions differed photoperiodically but specified the same amount of light from sun and fluorescent tubes. The farther north the seed source, the greater was the response to test conditions and the longer was the maximum "critical" day length that inhibited the seedlings. Interaction of seed source and photoperiod was analyzed and recorded by these responses: (1) Duration of elongation. Under certain day lengths, elongations of northern seedlings ceased while it continued in southern seedlings. (2) Amount of growth. (3) Lateral development. Numbers of side branches and buds were restricted in northern seedlings under short days. It is suggested that the photoperiodic ecotypes have evolved as an indirect mechanism in the adaption of trees to various seasonally changing climate factors. Thus, they are only approximately similar at different sites in each latitude.

1613. _______ and Salisbury, P. J.
1961. Potential pathogenicity of *Pythium* isolates from forest nurseries. Phytopathology 51(8): 505-507.

1614. Vabre, A.
1954. L'hybride *Tsugo-Picea hookeriana* et ses parents: étude des plantules. [The hybrid *Tsugo-Picea hookeriana* and its parents: A study of the seedlings.] Trav. Lab. Forest. Toulouse 1, vol. 5, art. 15, 8 pp., illus. [In French.]

Purports to confirm that *Tsuga hookeriana* is a hybrid of *T. heterophylla* and *Picea sitchensis.*

1615. Vabre-Durrieu, A.
1954. L'hybride *Tsugo-Picea hookeriana* et ses parents: etude chromosomique et caryologique. [The hybrid *Tsugo-Picea hookeriana* and its parents: a cytological and caryological study.] Trav. Lab. Forest. Toulouse 1, vol. 5, art. 17, 4 pp., illus. [In French.]

1616. ________
1956. Le froid et les graines de quelques Abietacees. [The reaction to cold of seed of some species of Abietineae.] Trav. Lab. Forest. Toulouse 1, vol. 5, art. 29, 6 pp. [In French.]

Sitka spruce is classified tentatively as having nondormant seed.

1617. Valk, U.
1960. Eestisse introdutseeritud kuused. [Spruces introduced into Estonia.] Eesti NSV Teaduste Akad. Toimetised, Tallinn (Bioloogiline Seeria) 1, pp. 60-65 plus 4 photos. [In Estonian. English summary.]

A tabulation of exotic spruces introduced into Estonia is given. Sitka spruce is described as rare, with poor to satisfactory growth, generally sensitive to frost, cone bearing, and generally suitable for cultivation in parks and gardens.

1618. Van Campo-Duplan, and Gaussen, H.
1948. Sur quatre hybrides de genres chez les Abietinées. [Four intergeneric hybrids among the Abietineae.] Trav. Lab. Forest. Toulouse 1, vol. 4, art. 24, 14 pp., illus. [In French.]

From studies of pollen morphology, the authors conclude that mountain hemlock, *Tsuga hookeriana* Murr. = *T. mertensiana* (Bong.) Carr., is an intergeneric hybrid between *T. heterophylla* and *Picea sitchensis*, for which they propose the name *Tsugo-Picea hookeriana.* (See also review by John W. Duffield, J. Forest. 48: 440.)

1619. Van Dersal, William R.
1938. Native woody plants of the United States, their erosion-control and wildlife values. U.S. Dep. Agr. Misc. Pub. 303, 362 pp., illus.

1620. Van Goor, C. P., and Jager, K.
1961. Chemische bestrijding van ongewenst loofhout in bosculturen door stambehandeling. [Chemical control of hardwoods in plantations by stem treatment.] Ned. Bosbouw Tijdschr. 33(5): 137-138. [In Dutch. English summary.]

1621. Varty, I. W.
1953. "*Cinaropsis pilicornis*": A rare aphid attacking spruce transplants. Scot. Forest. 7(3): 86-87.

Describes the insect and reports an outbreak on 2+2 Sitka spruce transplants in Nevis nursery. Control consisted of spraying three times with an emulsion of paraffin and soft soap.

1622. Veitch, James, and Sons.
1881. A manual of the coniferae, containing a general review of the order; a synopsis of the hardy kinds cultivated in Great Britain; their place and use in horticulture.... 350 pp., illus. Chelsea: James Veitch and Sons.

1623. Venables, L. S. V., and Venables, U. M.
1948. A Shetland bird population: Kergord Plantations. J. Anim. Ecol. 17(1): 66-74 plus 2 photos.

The largest area of woodland on Shetland is at Kergord, Weisdale, where some 8 to 9 acres of mixed plantations are growing well. The dominant species are *Acer pseudoplatanus*, *Larix leptolepis*, and *Picea sitchensis*. In addition to a report on bird ecology, a short history of the plantations with a list of tree and shrub species is given.

1624. Venet, J.
1955. Le bois et les bateaux de guerre, de commerce et de plaisance. [Wood and warships, merchant vessels, and pleasure boats.] Rev. Bois Appl. 10(1): 17-24, illus. [In French.]

1625. Versepuy, Michel.
[n.d.] Nomenclature pratique des principales gymnospermes. [Illustrated catalog of the principal gymnosperms.] 111 pp., illus. Le Puy, France: Jeanne D'Arc. [In French.]

Contains brief descriptions and illustrations of many gymnosperm species, with notes on seed. Also contains a description, historical account, and photos of Versepuy seed extraction plant with information on seed procurement, handling, processing, and practical suggestions for planting.

1626. Vidakovic, Mirko.
1963. Meduvrsno krizanje Panciceve omorike (*Picea omorica* (Pancic) Purkyne) sa Sitkanskom smrcom (*Picea sitchensis* (Bong.) Carr.). [Interspecific crossing between (*Picea omorika* (Pancic) Purkyne) and Sitka spruce (*Picea sitchensis* (Bong.) Carr.).] Sumarstvo 16: 337-342, illus. [In Slovak. English summary.]

1627. Viereck, Leslie A.
1967. Botanical dating of recent glacial activity in western North America, pp. 189-204, illus. *In* Arctic and alpine environments, H. E. Wright, Jr., and W. H. Osburn [eds.]. Bloomington: Indiana Univ. Press.

1628. Vincent, Robert E.
1958. The larger plants of Little Kitoi Lake. Amer. Midland Natur. 60(1): 212-218, illus.

1629. Vite, J. P., and Rudinsky, J. A.
1959. The water-conducting systems in conifers and their importance in the distribution of trunk-injected chemicals. Boyce Thompson Inst. Contr. 20(1): 27-38, illus.

The routes by which water is conducted upward in conifers were studied by injecting acid fuchsin near the base of young to middle-aged trees. Five different patterns of translocation were detected in the sapwood of the conifers examined. These, and the way they affect distribution of the injected materials, are described. Type A, the spiral ascent, turning right, is characteristic of the investigated species of *Picea*.

1630. Volkert, Erik.
1956. Holzeigenschaften von Gastbaumarten. [Wood properties of exotic species.] Holz Als Roh- und Werkstoff 14(3): 81-86, illus. [In German.]

1631. Voute, A. D.
1947. Het optreden van den sparrenbastkever (*Dendroctonus micans* Kug.) in ons land en de mogelijkheid tot het voorkomen van de plaag. [The occurrence in Holland of *Dendroctonus micans* and possibilities of controlling this pest.] Ned. Boschbouw-Tijdschr. 19(3): 85-87.

Sitka and oriental spruces of 35 or more years of age are susceptible to attack. The life history of the insect in Holland is described.

1632. Wade, Leslie Keith.
1965. Vegetation and history of the sphagnum bogs of the Tofino area, Vancouver Island. 125 pp., illus. (M.S. thesis on file at Univ. Brit. Columbia.)

Within the study area, pure Sitka spruce stands lie adjacent to the open ocean, occupying a narrow strip along the bank and along the surface of the coastal terrace. The strip of spruce is nowhere more than a few hundred feet wide, always fronting the open ocean. It is inferred that the distribution of Sitka spruce is in some manner controlled by the presence of the open ocean. Analysis of pollen profiles in a shallow (150-centimeter) bog is described. Spruce pollen was among the tree species found.

1633. Wagener, Willis W., and Davidson, Ross W.
1954. Heart rots in living trees. Bot. Rev. 20(2): 61-134.

1634. Wakefield, W. E.
1957. Determination of the strength properties and physical characteristics of Canadian woods. Can. Dep. Northern Aff. & Natur. Resources Forest. Br. Bull. 119, 64 pp., illus.

1635. Walker, K. J. S.
1963. Sawmill study: work cycle times on a rackbench. Forest Prod. Res. (London) Spec. Rep. 17, 23 pp., illus.

1636. Wandt, Oldenburg, and Barelmann, Nordhorn.
1963. Düngungsversuche im Emsland. [Fertilizer trials in the Ems region.] Allg. Forstz. 18(42): 664-669, illus. [In German.]

1637. Wangaard, Frederick F.
1950. The mechanical properties of wood. 377 pp., illus. New York and London: John Wiley & Sons, Chapman & Hall.

1638. Warcup, J. H.
1951. The effect of partial sterilization on the occurrence of fungi in the soil. *In* Report on forest research for the year ended March 1950. Great Brit. Forest. Comm., pp. 107-110. London: H. M. Stationery Office.

1639. ________
1952. Effect of partial sterilization by steam or formalin on damping-off of Sitka spruce. Brit. Mycol. Soc. Trans. 35(4): 248-262, illus.

Three species of *Pythium* isolated from alkaline soil of an old established nursery at Ampthill were found to be parasitic to Sitka spruce seedlings. Symptoms varied from typical damping-off to a slow root-rot. Not all infected seedlings died, some surviving as stunted plants with partly diseased root system. Steam or formalin treatment markedly improved numbers and height of Sitka spruce seedlings in the first year after treatment and showed a moderate residual effect in the second year, but gave little improvement in the third year. (From author's summary.)

1640. Ward, J. D. U.
1952. A woodman's diary. 352 pp., illus. London: Routledge and Kegan Paul.

1641. Wardle, P. A.
1967. Spacing in plantations. Forestry 40(1): 47-69.

An approach to management decisionmaking is described using spacing as an example. Sitka spruce data are used to illustrate some of the main points.

1642. ________
1967. Valuation in accounts - a comparison of methods. Fourteenth IUFRO Kongress (München), Vol. VIII, Sec. 31, Working Group 1, pp. 29-51.

1643. Waring, H. D.
1953. Unexplained death of spruce in U. K. Australian Forest. 17(2): 49-54.

Nine sites have been examined on which Norway and Sitka spruce, 20 to 40 years old, are dying. The symptoms are discussed and comparisons made with the deaths of *Pinus* species which have been studied in Australia in recent years. It is suggested that the primary cause of mortality in both countries might lie in an upset of the balance between soil moisture and aeration and be accentuated by a restriction of the growing space for roots. (Author's summary.)

1644. Warrack, G. C.
1957. Natural regeneration in the Queen Charlotte Islands, p. 25. *In* Forest research review year ended March, 1957. Dep. Lands & Forests, Brit. Columbia Forest Serv.

With increased logging in the Queen Charlottes, natural regeneration can be expected to establish an adequate second crop of mixed hemlock-spruce-cedar, provided that the extent of contiguous clearcut areas is limited to 900 acres, preferably less; and encircling seed source within one-half mile is left for a period up to 10 years; and the amount of slash cover is reduced by 50 percent. Real efforts will have to be made to artificially regenerate within 3 years of clearcutting rich sites prone to early reclamation by alder, shrubs, and grasses. Protection of costly planted stock against heavy deer browsing may have to be contemplated in addition to the usual fire-protection measures. Burning has resulted in purer stands--mainly composed of Sitka spruce--but it is not a requisite to regeneration. (From author's summary.)

1645. Warren, H. V., Delavault, R. E., and Irish, Ruth I.
1952. Biogeochemical investigations in the Pacific Northwest. Geol. Soc. Amer. Bull. 63(5): 435-484.

Normal and abnormal, or anomalous, contents of copper and zinc in different organs of various ages have been determined and tabulated for the more common trees and lesser plants of the Pacific Northwest including Sitka spruce.

1646. Washington State Department of Natural Resources.
1967. Timber harvest report 1966. 73 pp.

Includes volumes of Sitka spruce. A similar report has been prepared annually since 1949.

1647. _______
1967. Washington State annual cone crop report--1967. 14 pp., illus.

Includes ratings of the 1967 Sitka spruce cone crop in the State of Washington. Similar reports have been issued since 1958.

1648. Waterman, Alma M., and Hansbrough, J. R.
1957. Microscopical rating of decay in Sitka spruce and its relation to toughness. Forest Prod. J. 7: 77-84, illus.

Sitka spruce blocks were subjected to decay in pure cultures of five brown-rot and three white-rot fungi, and the degree of decay rated in eight classes according to the extent of the presence of hyphae, bore holes, and decomposition of cell walls in the individual tracheids of a microscopical field. Decay ratings and toughness ratings were combined for test pieces cut from two boards naturally infected with *Poria monticola*.

1649. Waters, D.
1967. Brashing. Quart. J. Forest. 61(3): 234-237.

Discusses costs and benefits of removal of branches from the lower six feet of Sitka spruce stems.

1650. Watson, H.
1928. Notes on attack by *Rhizoctonia crocorum* on Sitka spruce (*Picea sitchensis*). Scot. Forest. J. 42: 58-61.

1651. Weatherell, J.
1953. The checking of forest trees by heather. Forestry 26(1): 37-40.

Experiments on podzolized heather moor at Allerston Forest have shown that a heather mulch applied around checked *Picea sitchensis, P. abies,* and *Chamaecyparis lawsoniana,* or more simply the elimination of living heather by surface hoeing, produces improved color and vigor of the trees. It has also been demonstrated that the addition of a nitrogenous fertilizer to checked Sitka spruce can, at least temporarily, alleviate the condition of check. (Author's summary.)

1652. ______
1957. The use of nurse species in the afforestation of upland heaths. Quart. J. Forest. 51(4): 298-304.

Some early observations on the effects of nurse crops on Sitka spruce in an experimental area on the upland heaths (of north Yorkshire) are recorded. It was found that the importance of the nurse crop was due to its capacity to reduce competition from heather, rather than to any sheltering effect. Spruce roots were found to spread under the nurse crop, especially where this was Japanese larch, when they root in the larch litter and surface soil, by then free from heather. Some problems of tending the crop so as to give the spruce room to grow without removing all the nurse species and permitting the return of the heather are explained, and various patterns for mixing the species less intimately are described. The early indications of these new experiments are given. (Author's summary.)

1653. Wechel, A. Te.
1939. Verdere gegevens over de duurzaamheid van heiningpalen. [Further data on the durability of fence posts.] Ned. Boschbouw Tijdschr. 12(9): 343-351, illus. [In Dutch.]

Sitka spruce was rated very durable.

1654. Weck, J.
1958. Zur Wiederbewaldung "Atlantischer Heiden" insbesondere in Nordwestdeutschland. [The afforestation of "Atlantic Heaths," with special reference to northwest Germany.] Allg. Forstz. 13(35): 481-485, illus. [In German.]

Norway and Sitka spruce, and Japanese larch with birch, followed by mixtures of hardwoods and high-yielding exotics are advocated.

1655. Weidner.
1949. Die Fichtengallen der Douglasienlaus (*Gilletteella cooleyi* Gill.). Bei Hamburg (Aphid. Chermesidae). [Spruce galls of *Adelges coolleyi* near Hamburg.] Z. Pflanzen Krankh. 56(7/9): 291-292, illus. [In German.]

Galls of *A. cooleyi* have been found in great numbers on *Picea sitchensis, P. glauca,* and *P. abies* in the Hamburg region; gall formation has previously occurred only rarely in Germany.

1656. Weisgerber, John F.
1963. Soil and cover conditions after Wyssen skyline and high-lead logging. Thirteenth Annu. Alaska Sci. Conf. Proc., pp. 88-90.

Soil disturbance was severe on 0.4 percent and mild on 2.6 percent of an area logged with the Swiss-developed Wyssen Skyline Crane. Slash accumulations were heavy on 7 percent of the logged area. Stocking with tree reproduction was 85 percent, with 1,200 to 1,500 seedlings per acre. Logging with a conventional high-lead system caused severe soil disturbance on 33.4 percent and mild disturbance on 15.1 percent of the area. Slash accumulations were heavy on 10.3 percent of the high-lead logged area. Stocking with tree reproduction was 35 percent with from 300 to 400 seedlings per acre. Species composition of both seedling stands was about 75 percent western hemlock and 25 percent Sitka spruce.

1657. Wells, Sidney D., and Rue, John D.
1927. The suitability of American woods for paper pulp. U.S. Dep. Agr. Bull. 1485: 102, illus.

1658. Wellwood, R. W.
1960. The utilization of spruce in Canada. Forest. Chron. 36: 126-135.

1659. West, W. I.
1949. A collection of Oregon woods. Oreg. State Coll. Progr. Rep. 1., Circ. 1, 31 pp., illus.

Purpose of the article is to make known this collection's existence. Seven specimens of Sitka spruce are included.

1660. West Coast Lumbermen's Association.
1922. Standard classification, grading and dressing rules for Douglas-fir, Sitka spruce, western redcedar, west coast hemlock, and Port-Orford-cedar products. 107 pp., illus. Seattle, Wash.

1661. ______
1940. Sitka spruce. 36 pp., illus.

1662. ______
1945. Sitka spruce lumber. 7 pp., illus. Portland, Oreg.

1663. ______
1956. Standard grading and dressing rules for Douglas-fir, west coast hemlock, Sitka spruce, western redcedar lumber. No. 15, 338 pp., illus. Portland, Oreg.

1664. Western Conservation Journal.
1963. Blowdown issue. Western Conserv. J. 20(4).

This issue carries several articles concerning the blowdown of October 12, 1962, which damaged many Sitka spruce stands in Oregon and Washington.

1665. Western Forestry and Conservation Association.
1929. Co-operative forest study of the Grays Harbor area. 79 pp., illus. Portland, Oreg.

Report of a survey of Grays Harbor County, Wash., with recommendations for forest protection and management of coastal forest types.

1666. ______
1953. Reports of the Pacific Northwest seeding and planting committee on various recommended reforestation practices and techniques. 69 pp. Portland, Oreg.

1667. Western Wood Products Association.
1966. 1964-65 statistical yearbook. A book of facts on western region woods. 17 pp. Portland, Oreg.

Includes data on Sitka spruce lumber production in Western States except coastal California. A supplement published in 1966 contains revised data for 1964 and preliminary data for 1966. Similar reports published in previous years.

1668. Weston, G. C.
1957. Indigenous v. exotic species in New Zealand forestry. *In* Exotic forest trees in New Zealand. Seventh Brit. Commonwealth Forest. Conf., Australia and New Zeal., pp. 37-38, illus.

1669. Westra, J. J.
1959. Een orienterend onderzoek naar de oorzaken van groeistoornissen in de bosbeplantingen in de Noordoostpolder. [A preliminary study on the causes of growth disturbances in plantations on northeast polder.] Uitvoer. Versl. Bosbouwproefsta., Wageningen 4(2): 26. [In Dutch. English summary.]

Physical properties of soils, especially structure and water economy, seemed to have more effect on growth of oak, ash, Japanese larch, Sitka spruce, and alder than chemical properties had.

1670. Whitaker, J. D.
1954. The edge effect in nursery beds. J. Oxford Univ. Forest. Soc. 4(2): 22-24.

An edge effect in nursery seedbeds of Sitka spruce was investigated. The outer rows of seedlings tend to be larger and of better color than seedlings from the center of the bed, a difference usually attributed to diminished competition for moisture. As a result of the present investigation, it is concluded that the superior growth of such marginal seedlings can be interpreted in terms of an improved N nutrition. Conversely, the severe competition for N inside the bed reduces seedling growth there and, in the absence of any marked change in the Fe or Mn uptake by the plant, leads to corresponding accumulation of these elements in the tissues.

1671. White, P. J.
1956. Note on the performance of Sitka spruce on a deep peat. Irish Forest. 13(1): 15-16.

Describes growth of a small plantation (268 trees) made in 1912 in County Clare. Mean height is now 87 feet and mean quarter girth at breast height is 11-3/4 inches.

1672. White, Phillip R.
1962. Information wanted: Letter to the editor. Amer. Forests 68(7): 4-5, illus.

The letter refers to a photograph in the May 1962 issue, showing massive tumorous growths on Sitka spruce trees. Dr. White sent in additional pictures which appeared in the July issue and pointed out that these growths also occur on white spruce.

1673. Whitford, H. N., and Craig, R. D.
1918. Forests of British Columbia. 409 pp., illus. Ottawa: Can. Comm. Conserv.

1674. Wiedemann, Alfred Max.
1966. Contributions to the plant ecology of the Oregon coastal sand dunes. 270 pp. (Ph.D. thesis on file at Oreg. State Univ.. Corvallis.) Diss. Abstr 27(9): 3005-B.

Describes plant succession on areas where the sand is eroded by wind to, or near, the water table. Vegetation develops into an impenetrable thicket with increasing dominance of *Pinus contorta* and *Picea sitchensis*. Eventually the shorter lived pine dies out leaving a forest of spruce.

1675. Will, G. M.
1962. The uptake of nutrients from sterilized forest-nursery soils. New Zeal. J. Agr. Res. 5(5/6): 425-432, illus.

Soil sterilization trials were carried out in seven nurseries in the North and South Islands to test the possibility of increasing productivity by this means. Even where soil pathogens were not a problem, seedling growth, including Sitka spruce, was improved. Chloropicrin proved more effective than formaldehyde. The greatest increases in growth and nutrient (N, P, and K) uptake occurred in pumice-soil nurseries. However, in these soils, the beneficial effect lasted for 1 year only--thereafter growth and nutrient uptake were reduced. (From author's summary.)

1676. Williamson, Richard L.
1965. Silvicultural and economic aspects of removal of scattered overmature trees from a well-stocked pole stand in the Sitka spruce-western hemlock type. (M.F. thesis on file at Oreg. State Univ., Corvallis.)

Financial analysis showed an economic advantage for immediate removal of a scattered old-growth Douglas-fir overstory from a well-stocked 38-year-old stand of Sitka spruce and western hemlock. Subsequent growth of the young stand was proportional to residual volume; decay in logging wounds had little effect on net growth.

1677. Wilmes, L. W.
1953. De aanleg van de beplantingen en de boscomplexen in de Noordoostpolder. [Tree plantings and the forest in the northeast polder.] Van zee tot Land 9: 2-63.

Describes plantings along roads, on farmlands, and around cities of the northeastern polder in Holland. In one area where there is peat, the main species are Sitka spruce, ash, and sycamore.

1678. Wilson, J. W.
1964. Wood characteristics. III: Intra-increment physical and chemical properties. Summary of studies in progress at UBC. Pulp & Pap. Res. Inst. Can. Res. Note 45, 9 pp.

1679. _______ and Wellwood, R. W.
1964. Intra-increment chemical properties of certain western Canadian coniferous species, pp. 551-559, illus. *In* Cellular ultrastructure of woody plants, Wilfred A. Cote [ed.]. Advance. Sci. Seminar Pinebrook Conf. Center Proc. Syracuse: Syracuse Univ. Press.

1680. Wilson, Sinclair A.
1929. Key to native trees of Oregon. Part I. Conifers and yews (Gymnosperms). Compiled in cooperation with Pacific Northwest Forest Exp. Sta. 2 pp.

1681. Winjum, Jack K., and Cummings, W. H.
1961. Effects of N, P, and K fertilizers on nursery-grown trees and shrubs common to Douglas-fir forests. Weyerhaeuser Co. Forest. Res. Note 43, 12 pp., illus.

In an effort to produce vigorous plants in the nursery, for herbicide trials, N, P, and K were applied at various rates in spring 1958 and 1959 to 16 species of the Douglas-fir region (five conifers, including Sitka spruce, six hardwoods, four shrubs, and one fern). Responses are discussed.

1682. Winkenwerder, Hugo.
1914. Short keys to the native trees of Oregon and Washington. Ed. 3, 16 pp. Seattle: Imperial Pub. Co.

1683. Wood, Lyman W.
1960. Variation of strength properties in woods used for structural purpose. USDA Forest Serv. Forest Prod. Lab. Rep. 1780, 11 pp. plus 21 graphs, 3 tables.

A survey of the variability of strength properties in southern yellow pine, Douglas-fir, Sitka spruce, western hemlock, eastern hemlock, Ponderosa pine, white oak, northern red oak, and red gum. (From author's summary.)

1684. Wood, R. F.
1950. Provenance studies. *In* Report on forest research for the year ended March 1949. Great. Brit. Forest. Comm., pp. 50-56. London: H. M. Stationery Office.

Sitka spruce from the Masset District, Queen Charlotte Islands, B.C., showed the greatest height growth in an experiment at Kielder.

1685. _______
1955. Studies of northwest American forests in relation to silviculture in Great Britain. Great Brit. Forest. Comm. Bull. 25, 42 pp. plus 35 photos.

During 1952 and 1953, the author visited the forests of British Columbia and the Pacific Northwest of the United States. He discusses growth of the principal tree species (*Picea sitchensis, Pseudotsuga taxifolia, Tsuga heterophylla, Thuja plicata, Pinus contorta, Abies amabilis,* and *A. grandis*), as observed in northwest America, with particular reference to forestry practice in the British Isles. Climatic comparisons, distribution and limits of species, silvicultural notes on the principal species and associations, and provenance questions are included.

1686. _______
1955. The use in Great Britain of certain northwest American species. Empire Forest. Rev. 34(3): 247-251.

Gives some notes on *Pseudotsuga taxifolia, Picea sitchensis, Tsuga heterophylla,* and *Pinus contorta* and their natural habitat, discusses current planting practice with these species in Great Britain, and suggests the best growing conditions for each.

1687. _______
1965. Review of the year's work. *In* Report on forest research for the year ended March 1964. Great Brit. Forest. Comm., pp. 1-10. London: H. M. Stationery Office.

1688. _______
1967. Review of the year's work. *In* Report on forest research for the year ended March 1967. Great Brit. Forest. Comm., pp. 5-21. London: H. M. Stationery Office.

1689. _______ and Bryan, John.
1962. The silviculture and quality of Sitka spruce grown in Great Britain. Fifth World Forest. Congr. Proc. (Seattle) 1960, 3(sect. 6B): 1372-1374. [French and Spanish summary.]

1690. _______ and Holmes, G. D.
1957. Improvement of checked plantations. *In* Report on forest research for the year ended March 1957. Great Brit. Forest. Comm., pp. 39-40. London: H. M. Stationery Office.

1691. _______ and Holmes, G. D.
1957. Chemical bark peeling. *In* Report on forest research for the year ended March 1957. Great Brit. Forest. Comm., pp. 43-44. London: H. M. Stationery Office.

Trials of chemicals with a lower mammalian toxicity than sodium arsenite are described.

1692. _______ and Holmes, G. D.
1959. Silvicultural investigations in the forest: (A) South and central England and Wales: Improvement of checked plantations. *In* Report on forest research for the year ended March 1958. Great Brit. Forest. Comm., pp. 40-41. London: H. M. Stationery Office.

Three years after application of six hundredweight potassic superphosphate per acre, 20-year Sitka spruce is 5 to 6 feet high versus controls still in check at 1-1/2 to 2 feet. Large-scale mechanical broadcasting of triple superphosphate at rates up to six hundredweight per acre has been carried out, to evaluate the practicability and economics of such treatment. Elimination of dense heather by spraying with 2, 4-D had relatively little effect on crop growth in the first season after treatment, but the effects of added phosphate were greater in such cleared areas.

1693. _______, Holmes, G. D., and Fraser, A. I.
1962. Silvicultural investigations in the forest: (A) South and central England and Wales: wind stability studies. *In* Report on forest research for the year ended March 1961. Great Brit. Forest. Comm., pp. 29-30. London: H. M. Stationery Office.

Pulling-over trials have been carried out on Sitka spruce, 33 years old, growing on peat up to 24 inches deep, above mineral soils of different characteristics. Drainage increased the depth of rooting and slightly increased tree stability. Most trees rooted to the full depth of the peat, and the degree of root penetration into the mineral soil had more influence on stability than the total depth of rooting. For a given height, trees of high basal area tended to be more stable than trees of lesser basal area.

1694. _______ and Lines, R.
1959. Provenance studies: Sitka spruce. *In* Report on forest research for the year ended March 1958. Great Brit. Forest. Comm., pp. 55-57. London: H. M. Stationery Office.

1695. _______, Lines, R., and Aldhous, J. R.
1960. Provenance studies: Sitka spruce. *In* Report on forest research for the year ended March 1959. Great Brit. Forest. Comm., pp. 50-52. London: H. M. Stationery Office.

Sitka spruce provenance experiments in the north have shown highly significant differences in the percentage of trees with dead leaders following frost damage. A close relationship exists between the damage and the occurrence of trees with Lammas shoots, these being much more frequent in the Washington provenances than in those from the Queen Charlotte Islands. The possibility of using Washington or other southern seed sources for nonfrosty localities is discussed.

1696. _______ and Nimmo, M.
1962. Chalk Downland afforestation. Great Brit. Forest. Comm. Bull. 34, 45 pp. plus 24 plates.

1697. _______ and Westall, A. W.
1955. The forest plots. *In* Guide to National Pinetum and forest plots at Bedgebury. Ed. 2. Great Brit. Forest. Comm., pp. 23-56 plus 10 plates.

1698. Woods, J. B., Jr., and Hann, J. H.
1949. Preliminary report: the Cochran airplane seeding experiment. Oreg. State Board Forest. Res. Bull. 2, 36 pp., illus.

In 1945-46, 100 acres in Tillamook County, Oreg., were seeded by airplane with a mixture of five parts Port-Orford-cedar, two parts Sitka spruce, and one part western hemlock by weight, at a rate of one-half pound per acre.

1699. Wooldridge, David Dilley.
1961. Environmental factors related to growth and management of western hemlock (*Tsuga heterophylla* (Raf.) Sarg.). Diss. Abstr. 22(5): 1337.

1700. Worsley, R. G. F.
1959. The processing of pollen. Silvae Genet. 8(5): 143-148, illus.

1701. Worster, H., and Sugiyama, B. K.
1962. The carbohydrate content and composition of some western woods related to growth factors. Pulp & Pap. Mag. Canada 63(8): T395-T401, illus.

Sitka spruce contained 75 percent holocellulose compared with 72.4 percent for western hemlock and 73.1 percent for Pacific silver fir. Holocellulose isolated from fast growing Sitka spruce contained more hexosan and glucan and less pentosans than slow growing trees. Highly significant relationships exist between wood holocellulose content, site index of a stand of timber, and wood specific gravity for Sitka spruce.

1702. Worthington, Norman P.
1955. A comparison of conifers planted on the Hemlock Experimental Forest. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta. Res. Note 111, 5 pp.

In 1952, 1,000 Sitka spruce 3-0 seedlings were planted on the Hemlock Experimental Forest in cooperation with the St. Regis Paper Co. After 3 years survival percent was 66 percent, average height 5.4 feet. Rabbits damaged spruce only rarely, in contrast with other species. Sitka spruce appears capable of successful establishment.

1703. Wraber, Maks.
1951. Tuje drevesne vrste v naših gozdovih. [Foreign tree species in our forests.] Gozd. Vestn. 9(4): 94-103. [In Slovene.]

1704. Wright, Ernest, and Isaac, Leo A.
1956. Decay following logging injury to western hemlock, Sitka spruce, and true firs. U.S. Dep. Agr. Tech. Bull. 1148, 34 pp., illus.

The entry and spread of decay following logging injury to residual trees in partially cut stands were studied in western Washington and Oregon. A total of 27 different fungi were identified. On Sitka spruce, *Fomes pinicola* caused 34 percent; *Stereum* spp., 15 percent; and *Lentinus kauffmanii*, 11 percent of infections. Decay rate was slower for spruce than for hemlock at the start, but faster once the decay was established.

1705. _______, Rhoads, Arthur S., and Isaac, Leo A.
1947. Decay losses following logging injury in partially cut stands of western hemlock and Sitka spruce. Timberman 48(10): 52, 54, 72, 74, 76, illus.

Approximately half of the reserve trees injured by logging became infected with wood-rotting fungi in a period varying from 5 to 32 years. The decay following logging injury amounted to 41 percent of the calculated gross increment since logging of the western hemlock trees studied and

43 percent of the growth of Sitka spruce. On all areas studied there was windfall loss and mortality from causes in addition to decay. Measures to reduce losses are discussed.

1706. Wright, Jonathan W.
1955. Species crossability in spruce in relation to distribution and taxonomy. Forest Sci. 1: 319-349.

The result of 6 years' artificial-pollination experiments with 70 interspecific combinations is described. Detailed range maps are given and the comparative morphology of 31 species is tabulated. From the range, and from genetic and morphological data, it is concluded that *Picea glauca, P. engelmannii, P. pungens,* and *P. sitchensis* have a common, relatively recent origin and are probably related to Old World species through *P. jezoensis* of Japan. Crossability barriers appear to have arisen mainly from genic differentiation following isolation. Introgression is observable in western North America and in eastern Europe now and has probably played a significant role in the past.

1707. _______
1962. Genetics of forest tree improvement. FAO Forest. & Forest Prod. Stud. 16, 399 pp., illus.

1708. _______ and Finn, Raymond F.
1960. A bibliography on forest genetics and forest tree improvement, 1956-1957. U.S. Dep. Agr. Misc. Pub. 808, 85 pp.

Twenty-one references pertain to the genus *Picea* and 14 to *P. sitchensis*.

1709. _______ and Rudolf, Paul O.
1962. A bibliography on forest genetics and forest tree improvement, 1958-1959. U.S. Dep. Agr. Misc. Pub. 906, 93 pp.

Twenty-four references pertain to the genus *Picea* and 16 to *P. sitchensis*.

1710. Wright, K. G., and Baisinger, D. H.
1956. The silvicultural importance of the Sitka spruce weevil (*Pissodes sitchensis*) in coastal Oregon and Washington. Soc. Amer. Forest. Proc. 1955: 64-67.

It appears that hemlock will eventually dominate Sitka spruce in Youngs River plantation, Oreg., because of damage to spruce from *Pissodes sitchensis*. Intensity of weevil attack increases farther from the coast, with stands in the coastal fog belt relatively unaffected.

1711. Wright, Kenneth H.
1960. Sitka-spruce weevil. U.S. Dep. Agr. Forest Pest Leafl. 47, 6 pp., illus.

Describes the life stages, habits, damage, and control measures. The Sitka-spruce weevil (*Pissodes sitchensis* Hopk.) is the most serious insect enemy of young Sitka spruce throughout the range of the host tree in Oregon, Washington, and British Columbia. Intensive search has failed to locate the insect in Alaska.

1712. Wright, T. W.
1959. Use of fertilizers in the afforestation of deep peat. J. Sci. Food Agr. 10(12): 645-650, illus.

Phosphorus is frequently the primary factor limiting tree growth on deep peat. Phosphate manuring combined with deep plowing results in successful establishment on all but the worst sites. Foliage analysis has recently proved successful in diagnosing P deficiency. Recent studies have shown that, as the trees mature, natural supplies of other nutrients, particularly K, may become exhausted. Tabulated results are given for Sitka spruce.

1713. Wu, Yeng-Tsu.
1964. Intra-increment lignin content of five western Canadian coniferous woods. 43 pp. (M.S. Forestry thesis on file at Univ. Brit. Columbia.)

Lignin contents of extracted free wood meals prepared from three adjacent rings of mature wood, sampled at breast height, were determined according to the micro-method of Johnson, Moore, and Zank. Lignin content of Sitka spruce differed significantly within portions of growth increment. No significant differences were found between growth rings, but a slight increase in lignin content with age was observed. Early wood was higher in lignin content than late wood. Lignin contents were in the decreasing order of: hemlock, cedar, Pacific silver fir, Douglas-fir, and Sitka spruce.

1714. Wu, Y.-T., and Wilson, J. W.
1967. Lignification within coniferous growth zones. Pulp & Pap. Mag. Can. 68(4): T-159-T-164, T-171, illus.

1715. Wyckoff, J. M.
1923. The lumbering situation in Alaska. Lumber World Rev., Chicago. (November 10.) Pp. 64-66, illus.

1716. Wyman, Donald.
1943. Simple foliage key to the hemlocks and spruces. Arnoldia 3(11): 57-64, illus.

1717. Yeatman, C. W.
1955. Tree root development on upland heaths. Great Brit. Forest. Comm. Bull. 21, 72 pp. plus 32 photos and 29 diagrams.

Describes investigations of the root development of the principal conifers used extensively in plantations established on the upland heaths of northeast England and Scotland. Species include Japanese larch, Scots pine, Sitka spruce, lodgepole pine, and Corsican pine.

1718. Yde-Andersen, A.
1961. *Polyporus schweinitzii* Fr. i naletraebevoksninger. [*Polyporus schweinitzii* in conifer stands.] Friesia (Copenhagen) 6(5): 347-355, illus. [In Danish. English summary.]

A description of the fungus, its hosts, biology, etc., including observations on Danish permanent sample plots, where, of 15 sites investigated, four were found to be infected. Infection was most common and rot most developed in stands over 30 years old.

1719. Ying-pe, Chang.
1954. Bark structure of North American conifers. U.S. Dep. Agr. Tech. Bull. 1095, 86 pp., illus.

1720. Yokota, Tokuo, and Tarkow, Harold.
1962. Hygrothermal properties of wood. Forest Exp. Sta. Bull. (Meguro, Tokyo) 135: 73-88, illus. [In Japanese. English summary.]

1721. _______ and Tarkow, Harold.
1962. Changes in dimension on heating green wood. Forest Prod. J. 12: 43-45, illus.

Describes tests with specimens of green Sitka spruce heated under water. During the first heating to 80° C., volume and tangential dimensions increased, followed by a further increase on cooling to 30°, but subsequent heatings caused shrinkage.

1722. Yuen San Chen, Peter, and Hossfeld, Ralph.
1964. Effect of viscosity on permeability of Sitka spruce to aqueous glycerin. Tappi 47: 750-752, illus.

1723. Zach, L. W.
1951. Distribution of volume in southeast Alaska trees. USDA Forest Serv. Alaska Forest Res. Center Tech. Note 10, 1 p.

1724. Zach, Lawrence W.
1950. A northern climax, forest or muskeg? Ecology 31(2): 304-306.

In southeast Alaska, present logging operations are in subclimax stands which are often the pioneer or invasion forest types usually having a large proportion of Sitka spruce following glacial recession, river valley filling, landslides, windthrow, fire, and old cuttings. Older stands have progressed to an all-aged condition and are more defective and less valuable commercially. The author theorizes that these stands may be merely a later stage in a progressive succession to muskeg within the altitudinal and gradient limits of peat formation.

1725. Zak, B.
1965. Aphids feeding on mycorrhizae of Douglas-fir. Forest Sci. 11: 410-411, illus.

Aphids similar to *Pemphigus piceae* were observed on seedling *Tsuga heterophylla* and *Picea sitchensis*.

1726. Zareba, Ryszard.
1958. Obecny stan powierzchni doswiadczalnych z egzotami w Wirtach. [The state of the Wirty exotic trial plots today.] Sylwan 102(2): 45-61, illus. [In Polish.]

Species tried include Sitka spruce.

1727. Zehetmayr, J. W. L.
1951. Experiments in planting of upland heaths. *In* Report on forest research for the year ended March 1950. Great Brit. Forest. Comm., pp. 27-33. London: H. M. Stationery Office.

1728. _______
1952. Persistence of late-flushing characters in Norway and Sitka spruce. *In* Report on forest research for the year ended March 1951. Great Brit. Forest. Comm., pp. 82-83. London: H. M. Stationery Office.

1729. _______
1954. Experiments in the economics of brashing with special reference to some problems in experimental technique. Eleventh IUFRO Congress Proc. (Rome), 1953, part 2, sect. 32: 1036-1042.

1730. _______
1954. Experiments in tree planting on peat. Great Brit. Forest. Comm. Bull. 22, 110 pp. plus 25 photos.

Summarizes the results of numerous experiments carried out in various parts of Great Britain over a number of years, which have dealt mainly with methods of establishing crops of trees on peat.

1731. _______
1957. A trial of compost in planting on peat. *In* Report on forest research for the year ended March 1956. Great Brit. Forest. Comm., pp. 139-142. London: H. M. Stationery Office.

1732. _______
1960. Afforestation of upland heaths. Great Brit. Forest. Comm. Bull. 32, 145 pp. plus 34 photos.

The upland heaths comprise heather-clad land among the hills along the east side of Scotland and northern England. They are distinct from the peat-covered lands farther west.

1733. _______ and Farquhar, J.
1956. Pruning of conifers by disbudding. *In* Report on forest research for the year ended March 1955. Great Brit. Forest. Comm., pp. 102-106, illus. London: H. M. Stationery Office.

The method has interesting possibilities for Scots and Corsican pines and possibly even for Norway and Sitka spruces. After 6 years, the reduction in height growth through disbudding is not severe, though there is a considerable loss in girth increment. Fast-growing Douglas-fir has proved unsuitable for disbudding.

1734. Zeller, S. M., and Goodding, L. N.
1930. Some species of Atropellis and Scleroderris on conifers in the Pacific Northwest. Phytopathology 20: 555-567, illus.

1735. Zentsch, W., and Jahnel, H.
1960. Aussaatversuche mit stratifiziertem Forstsaatgut im Staatlichen Forstwirtschaftsbetrieb Rovershagen. [Tests with stratified seed at Rovershagen State Forest Estates.] Forst- und Jagdzeit. 10(2): 81-83, illus. [In German.]

1736. Ziller, W. G.
1954. Studies of western tree rusts. 1. A new cone rust on Sitka spruce. Can. J. Bot. 32: 432-439 plus 8 photos.

A new cone rust has been found damaging seed of Sitka spruce on the Queen Charlotte Islands and a new *Chrysomyxa* has been found on *Moneses* uniflora in the same area. Field observations, controlled inoculations, and similarity of markings on aeciospores and urediniospores have led to the conclusion that the cone rust is the aecial stage of an undescribed *Chrysomyxa*. The rust is described and has been named *C. monesis*. Surface sterilization of the spruce seed before export is recommended. (Author's summary.)

1737. ________
1957. Fungi of British Columbia deposited in the herbarium of the Forest Biology Laboratory, Victoria, B.C. Can. Dep. Agr. Forest Biol. Lab., 59 pp.

Contains a check list of fungi, showing host of each. Fungi are also listed by host. Sitka spruce is listed as host for 61 fungi.

1738. Ziller, Wolf G.
1965. Studies of western tree rusts. VI. The aecial host ranges of *Melampsora albertensis, M. medusae,* and *M. occidentalis*. Can. J. Bot. 43: 217-230.

Picea sitchensis seedlings inoculated with basidiospores of *Melampsora* spp. appeared to be highly resistant to infection. One percent of seedlings became infected in each case.

1739. Zim, Herbert S., and Martin, Alexander C.
1952. Trees: a guide to familiar American trees. 157 pp., illus. New York: Simon & Schuster.

1740. Zitzewitz, H. von.
1964. Zur empfindlichkeit verschiedener Holzarten gegen einige chemische unkrautbekampfungsmittel. [The sensitivity of various tree species to certain herbicides.] Forst- und Holzwirtsch. 19(5): 87-90. [In German.]

Describes the effects of dalapon on Scots pine, Norway spruce, larch, and beech, and of simazine and gesaprim on Douglas-fir, Sitka spruce, larch, *Acer pseudoplatanus,* and beech, when these herbicides were used for grass control in plantations. All species tolerated dalapon well (apart from Scots pine, which needed special care), if sprayed outside the growing season and if strength of the spray was regulated according to the species and conditions. Trials confirmed that simazine is effective on broadleaved species but is rapidly inactivated by raw humus. Gesaprim appears to be unsuitable for this purpose.

1741. Zycha, H.
1955. Eine Krebserkrankung der Sitka-Fichte (*Picea sitchensis* (Bong.) Carr.). [A canker disease of Sitka spruce.] Forstwiss. Centralbl. 74(9/10): 293-305, illus. [In German.]

Describes a canker disease of Sitka spruce found for the first time in Germany. The probable causal agent is *Nectria cucurbitula.* The disease is not considered important enough to require limiting the planting of Sitka spruce in Germany.

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COMMON AND SCIENTIFIC NAMES OF VEGETATION MENTIONED IN LITERATURE REFERENCES

Alaska-cedar	*Chamaecyparis nootkatensis* (D. Don) Spach
Ash	*Fraxinus* spp.
Balsam fir	*Abies balsamea* (L.) Mill.
Balsam poplar	*Populus tacamahaca* Mill.
Black spruce	*Picea mariana* (Mill.) B.S.P.
Blue spruce	*Picea pungens* Engelm.
Bracken	*Pteridium aquilinum* (L.) Kuhn. var. *pubescens*
Corsican pine	*Pinus nigra Poiretiana* (Ant.) Aschers. & Graebn.
Deodar cedar	*Cedrus deodara* (Roxb.) Loud.
Douglas-fir	*Pseudotsuga menziesii* (Mirb.) Franco
Eastern white pine	*Pinus strobus* L.
Engelmann spruce	*Picea engelmannii* Parry
European beech	*Fagus sylvatica* L.
European larch	*Larix decidua* Mill.
Grand fir	*Abies grandis* (Dougl.) Lindl.
Heather	*Calluna vulgaris* (L.) Hull.
Japanese larch	*Larix leptolepis* (Sieb. & Zucc.) Gord.
Lawson cypress	*Chamaecyparis lawsoniana* (A. Murr.) Parl.
Lodgepole pine	*Pinus contorta* Dougl.
Lutz spruce	*Picea* X *lutzii* Little
Mjombo	*Brachystegia boehmii* Taub.
Monterey pine	*Pinus radiata* D. Don
Morabukea	*Mora gonggrijpii* (Kleinh.) Sandw.
Mountain hemlock	*Tsuga mertensiana* (Bong.) Carr.
Mountain pine	*Pinus mugo* Turra

Muputu	*Brachystegia spicaeformis* Benth.
Noble fir	*Abies procera* Rehd.
Norway spruce	*Picea abies* (L.) Karst.
Oriental spruce	*Picea orientalis* (L.) Link.
Pacific silver fir	*Abies amabilis* (Dougl.) Forbes
Pacific yew	*Taxus brevifolia* Nutt.
Ponderosa pine	*Pinus ponderosa* Laws.
Port-Orford-cedar	*Chamaecyparis lawsoniana* (A. Murr.) Parl.
Red alder	*Alnus rubra* Bong.
Redwood	*Sequoia sempervirens* (D. Don) Endl.
Salmonberry	*Rubus spectabilis* Pursh.
Scotch broom	*Cytisus scoparius* (L.) Link.
Scots pine	*Pinus sylvestris* L.
Serbian spruce	*Picea omorika* (Pancic) Purkyne
Sessile oak	*Quercus petraea* (Matt.) Lieb.
Silver fir	*Abies alba* Mill.
Sitka alder	*Alnus sinuata* (Reg.) Rydb.
Sitka spruce	*Picea sitchensis* (Bong.) Carr.
Subalpine fir	*Abies lasiocarpa* (Hook.) Nutt.
Sugar maple	*Acer saccharum* Marsh.
Sycamore maple	*Acer pseudoplatanus* L.
Western hemlock	*Tsuga heterophylla* (Raf.) Sarg.
Western redcedar	*Thuja plicata* Donn
White spruce	*Picea glauca* (Moench) Voss
Yeddo spruce	*Picea jezoensis* (Sieb. & Zucc.) Carr.

Harris, A. S., and Ruth, Robert H.
1970. Sitka spruce--a bibliography with abstracts.
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The mission of the PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION is to provide the knowledge, technology, and alternatives for present and future protection, management, and use of forest, range, and related environments.

Within this overall mission, the Station conducts and stimulates research to facilitate and to accelerate progress toward the following goals:

1. Providing safe and efficient technology for inventory, protection, and use of resources.
2. Development and evaluation of alternative methods and levels of resource management.
3. Achievement of optimum sustained resource productivity consistent with maintaining a high quality forest environment.

The area of research encompasses Oregon, Washington, Alaska, and, in some cases, California, Hawaii, the Western States, and the Nation. Results of the research will be made available promptly. Project headquarters are at:

College, Alaska
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The FOREST SERVICE of the U.S. Department of Agriculture is dedicated to the principle of multiple use management of the Nation's forest resources for sustained yields of wood, water, forage, wildlife, and recreation. Through forestry research, cooperation with the States and private forest owners, and management of the National Forests and National Grasslands, it strives — as directed by Congress — to provide increasingly greater service to a growing Nation.